THE MEDICAL JOURNAL OF AUSTRALIA

VOL. I.—32ND YEAR. SYDNEY, SATURDAY, MAY 19, 1945. No. 20.

Table of Contents.

[The Whole of the Literary Matter in THE MEDICAL JOURNAL OF AUSTRALIA is Copyright.]

ORIGINAL ARTICLES— Page.
Bacteriological Findings in a Series of Cases during the 1943 Moorabbin Epidemic of Typhoid Fever, with Special Reference to the Cultural Examination of Bile, by Hilda J. Gardner .. 505
A Bacteriological Study of Fifty Patients in the 1943 Moorabbin Typhoid Epidemic, by Jean C. Tolhurst, Glen Buckle and A. Hyams 510
The Problem of Selection of Medical Students for Admission to the Quota for the Medical Course, by E. S. Meyers 515
Physiological Considerations in Vascular Surgery: Ligature of Main Arteries to the Limbs, by Lambert Rogers 517

REVIEWS—
Tropical Diseases 518

LEADING ARTICLES—
Woman and the Population Problem 519

CURRENT COMMENT—
Diabetes and Tuberculosis 521
The Action of Digoxin on the Circulation 521

ABSTRACTS FROM MEDICAL LITERATURE—
Bacteriology and Immunology 522
Hygiene 523

BRITISH MEDICAL ASSOCIATION NEWS— Page.
Scientific 524
Notice 525

MEDICAL SOCIETIES—
Melbourne Pædiatric Society 525

NATIONAL EMERGENCY MEASURES—
An Amendment of Control of Medical Equipment Order 526

CORRESPONDENCE—
These Initials 527

OBITUARY—
John Shewan 527
Albert George Corbin 527

NAVAL, MILITARY AND AIR FORCE—
Appointments 527

NOMINATIONS AND ELECTIONS 527

AUSTRALIAN MEDICAL BOARD PROCEEDINGS—
Queensland 528

MEDICAL APPOINTMENTS 528

BOOKS RECEIVED 528

DIARY FOR THE MONTH 528

MEDICAL APPOINTMENTS: IMPORTANT NOTICE .. 528

EDITORIAL NOTICES 528

BACTERIOLOGICAL FINDINGS IN A SERIES OF CASES DURING THE 1943 MOORABBIN EPIDEMIC OF TYPHOID FEVER, WITH SPECIAL REFERENCE TO THE CULTURAL EXAMINATION OF BILE.

By HILDA J. GARDNER,

Clinical Pathologist, Royal Melbourne Hospital, Melbourne.

AN outbreak of typhoid fever, with the explosive character of a milk-borne or water-borne epidemic, affected 440 persons at Moorabbin, an outer suburb of Melbourne, during March and April, 1943. This hospital, amongst others, was called upon to provide accommodation for these patients at short notice. An early patient was admitted to hospital on March 14, and 68 patients and the original carrier were admitted between March 24 and April 13. Three wards were made available for 52 female patients and one ward for 18 male patients.

It is to be regretted that, under wartime conditions affecting labour and materials, greater advantage could not be taken of the opportunity of studying many bacteriological aspects of an epidemic of this magnitude. Tests were mainly confined to those required for diagnosis, and during convalescence, to establish freedom from the carrier state prior to discharge of the patient from hospital. However, during these somewhat limited investigations, features of considerable bacteriological interest were demonstrated in some of the cases.

The epidemiological features of the outbreak have been fully described by Dr. C. R. Merrilees in a report to the Commission of Public Health,[1] and the bacteriological findings of the epidemic as a whole in the *Health Bulletin*.[2] Some of the data presented here are included in the latter statement.

AGE OF PATIENTS.

Table I gives the age distribution of patients and the number of proved cases of typhoid fever at this hospital, but gives no indication of the age incidence of the epidemic as a whole.

TABLE I.

Age in Years.	Number with Proved Diagnosis.	Discharged; Not Suffering from Typhoid Fever.	Clinically Mild Typhoid Fever; No Bacteriological Proof.	Original Carrier.
1 to 10	3	2	—	—
11 to 20	22	1	1	—
21 to 30	14	1	—	—
31 to 40	7	—	—	—
41 to 50	6	1	—	1
51 to 60	5	2	—	—
61 to 70	3	—	—	—
86	1	—	—	—
Total ..	61	7	1	1

BACTERIOLOGICAL DIAGNOSIS.

Of the 61 bacteriologically proved cases, the diagnosis was first established by blood culture in 56, by agglutination tests in two, by agglutination tests and fæces culture (same day) in one, and by urine culture in two.

Cultural Investigation of Blood.

During an epidemic of typhoid fever, a large majority of the cases are likely to be suspected during the early stage of the disease, so that the recovery of the causal organism from the blood stream will be achieved in a large percentage of cases. Blood was taken, as a routine measure, as soon as possible after the patient's admission to hospital, so that, if possible, a positive cultural result might be obtained. The medium used, except for the first few patients, was that recommended by Buxton and

Coleman,[3] and consisted of ox bile (900 cubic centimetres), glycerin (100 cubic centimetres) and peptone (20 grammes). This was bottled in amounts of twenty cubic centimetres and was sterilized by autoclaving. To this two to three cubic centimetres of the patient's blood were added. The small amount of blood required was an advantage in the case of children. According to Perry and Benstead,[4] cultural tests in fresh ox bile yield the most uniform results. Felix[5] also refers to the satisfactory results obtained with this medium. Of the 46 positive cultures obtained by this method, in 42 growth took place within twenty-four hours.

These cultures were plated on MacConkey's neutral red-bile salt-lactose agar and incubated overnight. When non-lactose-fermenting colonies were obtained, the organisms were identified by sugar reactions and slide agglutination tests, by means of an antiserum for *Bacterium typhosum* prepared by the Commonwealth Serum Laboratories (titre 1 in 10,000), diluted to 1 in 100.

Table II shows the number of patients from whom blood was taken for cultural tests and the number of positive results obtained, in relation to the stage of the disease as nearly as could be estimated from the patient's history.

TABLE II.

Probable Stage of Disease. (Days.)	Number of Cultural Tests.	Number from which *Bacterium typhosum* Isolated.
1 to 7	28	27
8 to 14	24	23
15 to 21	6	4
22 to 28	3	2
Total	61	56

The whole blood of three patients, which had yielded no growth of *Bacterium typhosum*, subsequently yielded positive results to cultural tests of clot separated from serum (see Table III). After separation of the serum for agglutination tests, the clot was inoculated in the bile medium and incubated. Felix[5] has pointed out that clot cultures frequently succeed when whole blood yields negative results. A specimen of coagulated blood will thus provide material for agglutination tests and a clot culture.

Three patients had relapses with the presence of *Bacterium typhosum* in the blood; two of these had been treated soon after their admission to hospital with typhoid paratyphoid A and B vaccine intravenously, with temporary improvement.

TABLE III.

Case Number.	Probable Duration of Disease. (Days.)	Results of Cultural Tests.	
		Whole Blood.	Clot.
1	3	Negative.	
	8		Positive.
37	9	Negative.	
	16		Positive.
67	10	Negative.	
	16		Negative.
	23		Positive.

Agglutination Tests.

As the diagnosis was established in 56 of the cases by recovery of *Bacterium typhosum* in blood cultures, it rested on the results of agglutination tests in comparatively few instances. Many of the patients received typhoid paratyphoid A and B vaccine prophylactically before their admission to hospital or therapeutically soon after their admission; this fact minimized the significance of detecting flagellar or somatic agglutinins in the serum. There were some points of interest, however, in the small number of tests which were carried out. Table IV shows the more significant results. For the detection of flagellar agglutinins, a 0·2% formol saline suspension of *Bacterium typhosum* isolated in Case 13 in the present epidemic was used. The organism was motile, and the patient from whom it was obtained developed a high titre (1 in 1,280) of agglutinins. The suspension was standardized to an opacity of 800,000,000 organisms per cubic centimetre, and gave flagellar agglutination to an end titre of 1 in 10,000 with antiserum prepared by the Commonwealth Serum Laboratories. For somatic agglutinins an alcoholized suspension of *Bacterium typhosum* 0901 diluted with 0·85% sodium chloride solution to an opacity of 800,000,000 organisms per cubic centimetre was used.

For flagellar agglutinins the results were read after incubation in a water bath at 52° C. for four hours and standing overnight at room temperature; for somatic agglutinins the results were read after incubation at 52° C. for twenty to twenty-four hours. The end-point was taken as that dilution in which flakes were seen in the fluid on inspection with the aid of a magnifying glass.

In those cases in which the serum contained flagellar agglutinins of low titre or in which the agglutinins were absent, these results were confirmed by the use of formolized suspensions prepared from stock strains of *Bacterium typhosum*. The strains of *Bacterium typhosum* isolated from these patients were all found to be motile.

TABLE IV.

Case Number.	Age of Patient. (Years.)	Probable Duration of Illness.	Titre of Agglutinins.		Comments.
			"H" Flagellar.	"O" Somatic.	
13	69	5·0 weeks.	1 in 320	1 in 160	Pneumonia and empyema. *Bacterium typhosum* in sputum and pus. Fæcal and urinary carrier.
		7·5 weeks.	1 in 1,280	1 in 80	
		10·0 weeks.	1 in 1,280	1 in 160	
		14·0 weeks.	1 in 1,280	1 in 160	
17	11	10·0 days.	Nil.	1 in 40	Clinically, mild typhoid fever. All cultural tests of blood, fæces and urine gave negative results.
		35·0 days.	Nil.	1 in 20	
20	53	3·0 weeks.	Nil.	1 in 320	Admitted to hospital in early third week. Result of cultural tests of blood negative, of fæces positive.
		4·0 weeks.	1 in 20	1 in 1,280	
		7·0 weeks.	1 in 160	1 in 320	
31	9	11·0 days.	Nil.	1 in 40	Cultural examination of urine gave positive results in eighth and ninth weeks; all other cultural tests of blood, fæces and urine gave negative results.
		16·0 days.	Nil.	1 in 40	
		3·5 weeks.	Nil.	1 in 40	
		5·0 weeks.	Nil.	1 in 40	
		8·5 weeks.	Nil.	1 in 20	
57	46	3·0 weeks.	Nil.	1 in 640	*Bacterium typhosum* isolated from fæces.
		4·0 weeks.	Nil.	1 in 640	
67	23	2·0 weeks.	1 in 40	1 in 160	Severe recrudescence during course of disease.
		3·0 weeks.	1 in 160	1 in 320	

These findings stress the necessity of examination for somatic as well as flagellar agglutinins in making a diagnosis by this method. Topley and Wilson[6] mention that in some cases of enteric infection "H" agglutinins fail to develop while "O" agglutinins are developed to a relatively high titre. Felix[5] found that in a small number of uninoculated patients the large flaking agglutinins were absent. A similar finding is recorded by Pijper[7] in South Africa.

Cultural Examination of the Fæces.

Cultural examination of the fæces was not undertaken during the pyrexial stage of the disease unless the clinical diagnosis had not been confirmed by the positive result of the cultural test of the blood. In one of eight cases in which the organism was not isolated from the blood, the diagnosis was made by this means.

The initial cultural examination for "clearance" prior to discharge of the patient from hospital was usually made after the temperature had remained normal for seven to ten days. This examination was repeated in five to seven days. At least three consecutive negative results were required before the patient was discharged from hospital as a non-carrier.

The use of selective media is essential to obtain reliable results. The value of such media as used in this epidemic is described in detail by Tolhurst *et alii*.[9] The media used in this laboratory included the following:

Fluid Media—

1. Nutrient broth with or without 10% of horse serum.
2. Brilliant green enrichment media containing 0·7 cubic centimetre, 0·4 cubic centimetre and 0·25 cubic centimetre of a 1 in 10,000 solution of the dye in 10 cubic centimetres of neutral peptone water.
3. Leifson's[9] selenite-F broth.

Solid Media—

1. MacConkey's neutral red-bile salt-lactose medium.
2. Wilson and Blair's bismuth sulphite-brilliant green agar prepared according to the modification of Hajna and Parry.[10]
3. Wilson and Blair's medium—dehydrated ("Difco").

The usual procedure in carrying out cultural tests was to make a heavy suspension of fæces in broth, from which transfers were made to brilliant green enrichment broth, MacConkey's agar and Wilson and Blair's medium. At a later stage selenite broth was used, and this was inoculated with fæces directly and from a suspension. After incubation overnight at 37° C. the broth cultures were seeded onto MacConkey's agar and Wilson and Blair's agar.

The results with Wilson and Blair's medium (Hajna and Parry's modification) were disappointing. Batches of the medium capable of giving consistently reliable results were difficult to prepare. The medium was poured into four-inch or six-inch Petri dishes, which were stored in the refrigerator and used for three or four days after preparation. Test plates inoculated with a diluted broth culture of *Bacterium typhosum* usually produced typical black umbonate colonies with a metallic sheen and a smoky halo. If the growth was profuse the colonies presented a green centre and pale periphery. Attempts at culture of fæces which were successful on MacConkey's agar were frequently unsuccessful on Wilson and Blair's medium. On the latter, growth was insignificant at the end of twenty-four hours, and after forty-eight hours there was often a heavy growth of other coliform organisms, chiefly the paracolon bacillus, *Bacterium coli anaerogenes*, *Bacterium alkaligenes* and also *Bacillus proteus*. These disappointing results are attributed to our lack of experience in the preparation and use of the medium, to the possible variation in the constituents under wartime conditions, and to lack of opportunity to trace the possible cause of these results.

Tolhurst[11] at another hospital was successfully using "Difco" dehydrated Wilson and Blair's medium, and a change to this preparation was made in the later stages of the work with satisfactory results. Greater success was attained by inoculating the plates directly from fæces than from a fæcal suspension.

The brilliant green enrichment broth frequently yielded a heavy growth of *Bacterium typhosum* in the case of one or more concentrations of the dye, but the use of three culture tubes with subsequent plating on MacConkey's or Wilson and Blair's agar is a disadvantage when many specimens are being examined. The use of Leifson's selenite-F medium gave most satisfactory results. In this instance also direct inoculation of the medium with fæces yielded better results than inoculation from a fæcal suspension. The medium proved highly inhibitory for other coliform organisms, and pure cultures of *Bacterium typhosum* were frequently obtained on plating. Subcultures were made on MacConkey's medium, on Wilson and Blair's medium (Hajna and Parry), or on "Difco" Wilson and Blair's medium. The best results were obtained by the combined use of selenite broth, MacConkey's agar and "Difco" Wilson and Blair's agar, primary cultures being made in selenite broth and Wilson and Blair's medium, and subcultures from selenite broth on MacConkey's agar and Wilson and Blair's medium. The use of such a medium as selenite broth greatly enhances the possibility of recovering *Bacterium typhosum*. In many instances, if reliance had been placed on a broth culture and inoculation on MacConkey's medium, a "false negative" result would have been returned.

As was expected, in many of the cases (33 in all) three consecutive negative results were obtained during convalescence. In an additional ten, one positive result was followed by three negative results. In six cases, *Bacterium typhosum* was excreted intermittently before the necessary three consecutive negative results were obtained and six patients were discharged from hospital as carriers.

Cultural Examination of Urine.

Cultural examination of urine was likewise not undertaken in the pyrexial stage of the disease unless the patient's condition indicated it. Three consecutive negative results were the criterion adopted for freedom from the carrier state, and 45 patients yielded entirely negative results. Eleven patients excreted *Bacterium typhosum* at least once during these tests.

Specimens of urine for cultural examination were collected with aseptic precautions between 6 a.m. and 2 p.m. and pooled. As *Bacterium typhosum*, if present in the renal tract, is excreted intermittently, it was thought that a pooled specimen might yield more reliable results. Approximately fifty cubic centimetres of urine were centrifuged and the deposit was inoculated into serum broth and onto MacConkey's agar. After overnight incubation the serum broth was seeded on MacConkey's agar. The organisms, if present, were usually in considerable numbers, and were easily isolated. The introduction of selenite broth as a selective medium for urinary cultures as well as for fæces was responsible for the isolation of *Bacterium typhosum* from three specimens, when other cultural tests gave negative results. Table V deals with those cases in which positive results were obtained during the course of the disease and the approximate stage of the disease.

The statement of Browning *et alii*[12] that, apart from the occurrence of the urinary carrier state, the organisms may be excreted occasionally in the urine when the focus of infection is confined to the intestine or gall-bladder, seems to be borne out in this series. These authors also discuss the pathogenesis of urinary carriers. There appears to be a diversity of opinion as to the mechanism by which the organisms appear in the urine. The bacilluria may be unaccompanied by pyuria. A process of filtration through intact kidneys is not a satisfactory explanation. It is more likely that small focal lesions develop in the kidney and rupture into the tubules, with discharge of the bacilli. Occasionally large abscesses may be present. It is also suggested that active multiplication may take place in some more or less restricted part of the mucosa of the urinary tract. Urinary carriers are not predominantly of one sex, as is the case with biliary carriers, and excretion of the organisms may be restricted to one kidney.

TABLE V.

Case Number.	Sex of Patient.	Age. (Years.)	Results of Cultural Examination of Urine.[1]	Remarks.
2	F.	23	−(50), +(60), −(64), −(66), −(68), −(74).	Two cultural tests of fæces gave negative results before positive results were obtained with urinary cultural tests.
7	M.	37	−(39), +(59), −(63), −(68), −(83), −(88).	Three consecutive cultural tests of fæces gave negative results before positive results were obtained with urinary cultural tests.
13	M.	69	+(64), +(81), +(84), −(92), followed by further negative results to −(523).	Persistent fæcal and biliary carrier.
31	M.	9	−(33), +(56), +(62), −(63), −(64), −(67), −(68), −(69), −(71).	Only specimens from which *Bacterium typhosum* was isolated. Clinically, mild typhoid fever; five fæces specimens examined with negative results.
37	F.	60	+(54), +(72), −(84), +(89), −(96), −(100).	Fæcal and biliary carrier.
47	F.	22	+(82), +(88), −(95), +(99), −(110), +(124), +(139), −(147), −(169), followed by three further negative results.	Four months pregnant. Discharged from hospital as fæcal carrier. Urine and fæces, persistently negative results after delivery.
60	F.	18	−(43), +(51), −(56), −(62), −(65), −(69).	Only positive bacteriological finding; five fæces specimens examined with negative results.
61	M.	19	−(44), +(59), −(63), −(64), −(65), −(77).	Three fæces specimens examined with negative results.
64	F.	53	−(62), −(68), −(76), +(97), +(108), −(122), −(145), −(157), −(171).	Persistent fæcal and biliary carrier.
66	F.	35	−(66), +(71), −(79), −(84), five negative results, +(171), −(232).	Biliary carrier, later intestinal carrier only.
67	F.	23	+(80), −(88), −(96), −(106), six further negative results.	Fæcal carrier.

[1] The numbers in parentheses refer to the approximate duration of the disease in days.

Cultural Examination of Duodenal Contents.

It is a well-recognized fact that the usually chosen criterion of three consecutive negative results to cultural tests of fæces and urine may not exclude the carrier state, and that the inclusion of the cultural examination of bile obtained by duodenal intubation is a valuable addition to the above tests. Positive cultures may be obtained from bile while the results with fæces are negative. The basis of two consecutive negative results to cultural tests of bile, together with two consecutive failures with fæces, as recommended by Garbet,[10] has much to commend it as the criterion of freedom from the intestinal carrier state. Occasionally a "false negative" result may be obtained on cultural examination of duodenal contents, either owing to obstruction of the cystic duct by a stone, or because the bile may be obtained from the liver without admixture with bile from the gall-bladder, which frequently acts as a test tube for the multiplication of the organisms. In carriers it is advantageous to demonstrate the presence of *Bacterium typhosum* in the bile before cholecystectomy is considered, as purely intestinal carriers do exist, although they are infrequent.

It was decided to examine at least once the duodenal contents of patients who had signs and symptoms of cholecystitis during the course of the disease, irrespective of age, and in the case of all women aged over thirty years, for it is this group which accounts for the majority of chronic fæcal excreters of *Bacterium typhosum*.

Duodenal Intubation.

The following was found to be a satisfactory method of obtaining bile by means of the duodenal tube:

After overnight fasting the patient was given a cup of broth at 6 a.m. A Rehfuss tube was passed at 8 a.m., the patient was placed on her right side and the foot of the bed was raised on blocks of medium height or, alternatively, the hips were raised six or eight inches by means of pillows. Some fluid was aspirated at about 10 a.m. This was frequently found to be acid to litmus and consisted of stomach contents. A further specimen was aspirated after an interval of half an hour to one hour. The tube had by this time generally passed into the duodenum and the specimen was alkaline in reaction. If no bile was obviously present, one ounce of a 50% solution of magnesium sulphate was introduced and another sample was obtained after a further half hour. A hypodermic injection of atropine sulphate (one one hundredth of a grain) was found useful when difficulty was encountered in the passage of the tube from the stomach to the duodenum.

Some of the patients were apprehensive at the first test, but cooperated satisfactorily at any subsequent intubations. The sample of aspirated material, containing bile, was inoculated directly on MacConkey's agar and also in bile medium or selenite broth with subsequent plating, after incubation, on MacConkey's agar if this was indicated. When *Bacterium typhosum* was present, profuse cultures were usually obtained on direct plating. Forty-one intubations were carried out on 26 patients, varying in age from seven to sixty-nine years. Twenty negative results were obtained for 19 natients. Table VI shows the results of the tests for the remaining patients and the original carrier.

Case 46 illustrates the value of cultural examination of duodenal contents. Particular care was taken with fæces examinations from this patient, selective media being used. In view of her age and symptoms of cholecystitis she was regarded as a possible carrier. However, four consecutive negative results of cultural tests of fæces were obtained before a positive result was obtained on June 8, 1943, prior to cholecystectomy. Bile and fæces examinations gave negative results following cholecystectomy.

Case 47 was that of a young woman who was seven months pregnant when discharged from hospital as a biliary, fæcal and urinary carrier. Following delivery at another hospital, cultural examinations of urine and fæces gave consistently negative results. She failed to report for a further bile examination, a negative result of which would have been a valuable addition to the other negative results of cultural tests in excluding the carrier state.

In Case 64 the patient was discharged from hospital as a biliary carrier and fæcal excreter. However, during the latter half of 1944 a series of negative results was obtained in fæces tests. In view of the fact that carriers may have periods of many months when they do not excrete bacilli, she probably cannot be regarded as naturally cured at this stage. The demonstration of negative results to cultural investigations of bile would be of considerable help in determining the public health policy in connexion with this patient.

In Case 66 two positive cultures were obtained from the bile, and then cultural examinations produced negative results. The patient has remained an intestinal carrier, and has reported at intervals to this hospital. This case demonstrates the importance of determining the presence of *Bacterium typhosum* in the bile before cholecystectomy is undertaken. In view of the fact that the patient was probably an intestinal carrier, she received a course of 34 grammes of sulphadiazine and one of 50 grammes of succinyl sulphathiazole. Both drugs produced an apparent temporary depression in the numbers of *Bacterium typhosum*, with return to profuse growth on culture media soon after the cessation of administration of either drug.

The patient in Case 70 was the original carrier responsible for the epidemic. *Bacterium typhosum* was cultured from her bile on two occasions prior to cholecystectomy, and one of the two fæces examinations gave positive results. On the ninth day after operation *Bacterium typhosum* was obtained from the fæces; this was followed

TABLE VI.

Case Number.	Sex and Age of Patient.	Results of Cultural Examination of Bile.			Remarks.
		Positive.		Negative.	
13	M. 69	24.6.43 29.8.43			Cholecystitis. Persistent fæcal excreter.
37	F. 60	12.5.43 27.5.43 18.6.43			Fæcal excreter. Intermittent urinary excreter.
46	F. 47	29.4.43 19.5.43 11.6.43	Cholecystectomy, 21.6.43 Bile+.	5.7.44 9.7.44 12.7.44	Acute cholecystitis. X-ray examination: non-filling gall-bladder containing two calculi.
47	F. 22	20.5.43 23.6.43			Four months pregnant on admission to hospital. Fæcal excreter. Intermittent urinary excreter.
64	F. 53	7.5.43 24.5.43 8.6.43			Fæcal excreter. Two positive results to cultural tests of urine.
66	F. 35	13.5.43 27.5.43		11.6.43 16.6.43 2.2.44	Intestinal carrier.
67	F. 23	18.6.43			Very severe illness. Fæcal carrier.
70 (Original carrier) Mrs. W.	F. 41	10.4.43 3.5.43	Cholecystectomy, 10.5.43 Bile+.	1.6.43 4.6.43 9.6.43	X-ray examination: non-functioning gall-bladder containing calculus. One positive and one negative result to cultural test of fæces after admission to hospital.

+ = *Bacterium typhosum* present.

by negative results from six specimens of fæces, three specimens of bile and four specimens of urine.

A patient, M.McG., aged thirty-two years, was admitted to hospital suffering from typhoid fever prior to the epidemic, and was probably not associated with it. The results of cultural tests of her fæces were positive over several months and the cultural tests of the bile also gave a positive result. The cultural results following cholecystectomy are of interest, and for this reason are set out in Table VII. After operation *Bacterium typhosum* was present in the bile for one month; this indicated that the organisms were also harboured in the liver and bile ducts. Three consecutive negative results then followed. One or more positive cultural results following cholecystectomy, therefore, do not necessarily indicate failure to cure the carrier state.

CARRIERS.

Of the six patients discharged from hospital as carriers, one was an elderly male who had symptoms of cholecystitis and has remained a biliary and intestinal carrier. Three of the five females were aged over thirty years, and the remaining two were aged respectively twenty-two and twenty-three years. The youngest patient was probably only a temporary carrier until after parturition.

Five patients were biliary carriers. From the sixth (Case 66), two initial bile cultures were obtained; but these were followed by consistently negative results and the patient must be regarded as an intestinal carrier. The urine of all carriers yielded *Bacterium typhosum* at some stage of the disease. The incidence of carriers, with the exclusion of the pregnant patient, is approximately 8·2% and is in excess of the usually accepted 2% to 5%. This, however, does not necessarily indicate the carrier incidence of the total number of patients affected in the epidemic.

COMPLICATIONS.

An outstanding feature was the number of complicating infections due to the *Staphylococcus aureus*.

Pneumonia and Pleural Effusion.

CASE 9.—A female patient, aged sixty-eight years, died of a complicating bronchopneumonia. A profuse culture of *Staphylococcus aureus* was obtained from the lung *post mortem*. No *Bacterium typhosum* was isolated.

CASE 13.—A male patient, aged sixty-nine years, had a complicating lobar pneumonia. *Bacterium typhosum* was isolated from the sputum on two occasions; it was accompanied by *Staphylococcus aureus* in the second specimen. An empyema developed, necessitating drainage. *Bacterium typhosum* was isolated from the pus on five occasions before healing was complete.

CASE 23.—A male patient, aged forty-six years, suffered from chronic pulmonary tuberculosis and typhoid fever with terminal bronchopneumonia. The causal organism of the pneumonia was not investigated.

CASE 35.—A male patient, aged thirty-seven years, suffered from bronchopneumonia and a pleural effusion. No satisfactory specimens of sputum or fluid were examined.

CASE 42.—A male patient, aged thirty years, suffered from lobar pneumonia. No *Bacterium typhosum* or *Streptococcus pneumoniæ* was isolated from the sputum, the most significant organism present being *Staphylococcus aureus*.

CASE 67.—A female patient, aged twenty-three years, suffered a severe recrudescence during the course of the disease, with bronchopneumonia. No sputum was available for culture. *Staphylococcus aureus* was grown from a pharyngeal swab. A sterile pleural effusion also developed.

Other Complications.

Furunculosis occurred in three patients during the course of their illness.

Membranous ulceration of the throat due to *Staphylococcus aureus* was a complication in one case.

Cholecystitis was present in seven patients, one of whom (Case 13) became a persistent carrier, and one (Case 46) had a cholecystectomy performed. In the remaining cases the bile ceased to yield cultures before the patient's discharge from hospital.

TABLE VII.

Patient.	Age (Years) and Sex of Patient.	Before Operation.		—	After Cholecystectomy.	
		Fæces.	Bile.		Fæces.	Bile.
M.McG.	F. 32	Many positive results to cultural tests obtained to 24.4.43	22.4.43+	Cholecystectomy, 3.5.43: Bile+.	6.5.43+ 14.5.43− 24.5.43− 31.5.43− 26.6.43−	27.5.43+ 4.6.43+ 11.6.43− 18.6.43− 24.6.43−

+ = *Bacterium typhosum* present; − = no *Bacterium typhosum* isolated.

Two cases of periostitis occurred.

M.J., a female, aged fifty-two years, was a patient at another hospital during the epidemic. She was admitted to this hospital on December 24, 1943, suffering from typhoid osteitis-periostitis of the right tibia and fibula requiring incision, again for a similar condition of the left tibia and fibula on July 6, 1944, and on October 7, 1944, for recurrence in the right fibula. *Bacterium typhosum* in pure culture was isolated from the pus on two occasions. The third specimen was not examined.

During this patient's stay in hospital *Bacterium typhosum* could not be grown from fæces or urine, and agglutination tests (flagellar and somatic) gave negative results.

A female patient, aged twenty-five years (Case 15), had signs and symptoms of periostitis of the right tibia, which subsided without incision.

Original Carrier.

The tracing of the carrier and the bacteriological tests involved in the investigation before her admission to hospital have been detailed in Dr. Merrilees's report on typhoid fever[1] and in the bacteriological report on the epidemic.[2] The subsequent relevant details are given in the discussion on cultural examination of duodenal contents.

Bacteriophage Typing.

The bacteriophage typing of virulent strains of *Bacterium typhosum* by the method of Craigie and Yen[13] is of great value in studying the epidemiology of an outbreak. It is also of some importance to ascertain which of Craigie and Yen's eighteen types are to be found in Australia. The strain from the original carrier and a selected number of strains from patients were all found to belong to Type E1.

The significance of typing has been stressed by the admission to hospital since the epidemic of a patient suffering from typhoid fever. An effort was made to ascertain whether the patient could have become infected from a carrier of the Moorabbin epidemic. Typing of the isolated organism, however, showed it to belong to Type A, which excluded relationship to this outbreak.

Summary.

The results of bacteriological tests on a series of 61 patients with typhoid fever, including cultural examination of blood, fæces, urine and bile, are discussed, and mention is made of the media used.

A number of patients intermittently excreted *Bacterium typhosum* in the urine.

The importance of examination of the duodenal contents in excluding the carrier state is stressed.

A brief account of complications is given.

The epidemiological significance of the typing of strains of *Bacterium typhosum* by bacteriophage is mentioned.

Acknowledgements.

My thanks are due to the honorary medical staff of the Royal Melbourne Hospital for permission to publish this report. Dr. Ruth Farrer and Miss B. M. Sandford were associated with the bacteriological work. I am greatly indebted to members of the Walter and Eliza Hall Institute of Research in Pathology and Medicine, particularly Miss F. E. Williams, for help with the media and with several problems arising during their use. Major T. C. Backhouse was responsible for the bacteriophage typing of the organisms from some patients and the original carrier, and Mr. Buckle for the typing of the strains from a later patient. The help of resident medical officers and sisters in charge of the patients in obtaining duodenal contents for cultural examination is gratefully acknowledged.

References.

(1) C. R. Merrilees: "Report on Typhoid Fever in the City of Moorabbin", 1943.
(2) "Bacteriological Report on Epidemic of Typhoid Fever in the City of Moorabbin, 1943", *Health Bulletin*, Numbers 75 and 76, 1943, page 2019.
(3) W. Coleman and B. H. Buxton: "The Bacteriology of Blood in Typhoid", *The American Journal of the Medical Sciences*, Volume CXXXIII, 1907, page 896.
(4) H. M. Perry and H. J. Bensted: "System of Bacteriology", Medical Research Council of the Privy Council, 1929.
(5) A. Felix: "The Qualitative Receptor Analysis in its Application to Typhoid Fever", *The Journal of Immunology*, Volume IX, 1924, page 115.
(6) W. W. C. Topley and C. S. Wilson: "The Principles of Bacteriology and Immunity", 1936.
(7) A. Pijper: "Serological Diagnosis of the Enterica", *The Journal of Hygiene*, Volume XXIX, 1930, page 380.
(8) J. C. Tolhurst, G. Buckle and A. Hyams: "A Bacteriological Study of Fifty Patients in the 1943 Moorabbin Typhoid Epidemic", THE MEDICAL JOURNAL OF AUSTRALIA, Volume I, 1945, page 510.
(9) E. Leifson: "New Selenite Enrichment Media for the Isolation of Typhoid and Paratyphoid (Salmonella) Bacilli", *The American Journal of Hygiene*, Volume XXIV, 1936, page 423.
(10) A. A. Hajna and C. A. Parry: "A Comparative Study of Selective Media for the Isolation of Typhoid Bacilli from Stool Specimens", *The Journal of Laboratory and Clinical Medicine*, Volume XXIII, 1937, page 1185.
(11) J. C. Tolhurst: Personal communication.
(12) C. H. Browning, H. L. Coulthard, R. Cruickshank, K. J. Guthrie and R. P. Smith: "Chronic Enteric Carriers and their Treatment", Medical Research Council of the Privy Council, Special Report Series Number 179, 1933.
(13) A. L. Garbet: "Monograph Number 16, Rockefeller Institute of Medical Research."
(14) J. Craigie and C. H. Yen: "The Demonstration of Types of B. Typhosus by Means of Preparations of Type II Vi Phage", *Canadian Public Health Journal*, Volume XXIX, 1938, page 448.

A BACTERIOLOGICAL STUDY OF FIFTY PATIENTS IN THE 1943 MOORABBIN TYPHOID EPIDEMIC.

By JEAN C. TOLHURST, GLEN BUCKLE AND A. HYAMS,

Bacteriologists to the Alfred Hospital, Melbourne.

THE typhoid epidemic involving more than 400 cases, which occurred in Moorabbin in 1943, was the largest outbreak in Victoria for many years. An account of the epidemic as a whole has appeared in the form of a public health report,[1] and a general statement of the bacteriological findings in which some of our own are incorporated has been published.[2] However, a detailed report of the bacteriological experiences of this laboratory may be of some interest.

Fifty-three patients suspected of suffering from typhoid fever were admitted to the Alfred Hospital, and in fifty cases the diagnosis was subsequently confirmed. It was decided to use cultural examination of the blood for diagnosis, and when typhoid bacilli were not cultivated, to resort to Widal tests and cultural examination of the fæces. In forty-four cases the diagnosis was made by cultures grown from the blood, four by Widal tests and two by cultures grown from the fæces.

Agglutination tests on serum from the patients were carried out for interest, and fæces and urine were culturally examined prior to the patient's discharge from hospital.

Cultural Examination of Blood.

The routine method for cultural examination of blood in this laboratory follows closely that established here by Butler.[3] The ward is supplied with an outfit containing the following equipment: (i) two all-glass five cubic centimetre or ten cubic centimetre syringes in glass or metal shields, a test tube containing needles, and another containing cotton wool swabs, all of which have been sterilized by autoclaving; (ii) three drop bottles containing 1% "Lysol" solution, alcohol and ether respectively; (iii) a set of media comprising (*a*) fifty cubic centimetres of Hartley's tryptic broth, (*b*) eight cubic centimetres of Wright's glucose broth with 0·5 cubic centimetre free trypsin (Fairchild's solution trypsin) added, (*c*) eight cubic centimetres of anaerobic tryptic broth with 0·5 cubic centimetre free trypsin added, and (*d*) eight cubic centimetres of ox bile. (The volumes are approximate.) During the typhoid epidemic it was decided to use only the first two media. Owing to its destructive effect on the bactericidal power of the blood, bile or bile broth is usually favoured for the cultivation of *Bacterium typhosum* from

the blood. However, we considered that tryptic broth and Wright's broth were good media for routine blood cultivation, and we took the opportunity of testing this view. Moreover, infections simulating typhoid fever might have occurred and been unrecognized if bile alone had been used.

A request was made to the doctor to add about four cubic centimetres of blood to the large tube (tryptic broth), and one cubic centimetre to the small tube (Wright's broth); as far as possible this was complied with, although in a few cases only one tube was inoculated.

In the taking of blood for cultural examination the area of skin over the selected vein was swabbed with "Lysol" solution, then flooded with alcohol and finally with ether. After withdrawal of the blood the needle was removed from the syringe and the blood carefully discharged into the media. This technique was satisfactory; in a total of 85 blood cultures only four were contaminated.

Inoculated media were examined every day for macroscopic evidence of growth; in its absence, smears were made on the third day. When growth occurred the Gram-negative bacilli were identified by agglutination with specific antiserum.

Cultures yielded *Bacterium typhosum* from six patients on the first day of incubation, from fourteen patients on the second day, from five on the third day and from the remaining nineteen between the third and eighth days. Inoculated media showing no growth after eight days were kept in the incubator for a month and examined every week.

In forty positive cultures the two media were compared: in thirty-one instances *Bacterium typhosum* was cultivated from both, growth appearing first in Wright's broth on fifteen occasions and first in tryptic broth on two occasions; in five instances growth was present in Wright's broth only, and in four in tryptic broth only. These results show that it is of advantage to use two media rather than one. Probably glucose broth containing active trypsin is the better medium, but the tryptic broth had the advantage of a larger inoculum of blood.

The relation of positive cultural findings to the probable stage of the disease is shown in Table I.

TABLE I.

Relation of Positive Cultural Findings in Blood to Probable Stage of Disease.

Probable Stage of Disease. (Days.)	Number of Patients Tested.	Number of Cultures Yielding Typhoid Bacilli.
1 to 7	25	22
8 to 14	16	14
15 to 21	7	6
Doubtful	2	2

In nine cases in which the first attempted blood culture was unsuccessful a second attempt was made; this was successful in five cases (Table II).

TABLE II.

First Attempt at Blood Culture Unsuccessful; Results of Second Attempt.

Patient.	Probable Stage of Disease. (Days.)	Result of First Attempt at Blood Culture.	Probable Stage of Disease. (Days.)	Result of Second Attempt at Blood Culture.
A.S. ..	8	–	13	+
A.J. ..	8	–	13	+
C.J. ..	12	–	17	+
A.P. ..	2	–	7	+
F.V. ..	9	–	15	+
H.S. ..	4	–	9	–
S.L. ..	4	–	10	–
B.A. ..	15	–	20	–
E.H. ..	10	–	13	–

Cultural Examination of Fæces.

As the majority of patients were proved by blood examination to be suffering from typhoid fever, specimens of fæces were not usually examined until the patients were convalescent, when it could be expected that many specimens would not yield *Bacterium typhosum*. The criterion for discharge from hospital was three consecutive negative results at intervals of from four to seven days. Patients were asked to return for a final test from six to twelve weeks after their discharge from hospital; all but six complied.

Of the fifty patients, four died, forty were discharged from hospital as free from infection, and six were fæcal carriers.

The number of methods of cultivation used for one specimen varied from one to six. Treatment of the specimens was modified according as experience suggested that some methods were better than others. The aim of the investigation, which was carried out in the course of routine work at a busy period and suffered disabilities on this account, was to make use of the available material for comparison of a number of media so that reliable cultural tests could be instituted. Specimens were handled as soon as possible after they were received—that is, usually within an hour, but occasionally not for several hours, the specimens meanwhile remaining at room temperature. All inoculations from one specimen were made at the same time. While an attempt was made to use the same amount of inoculum in comparing two specimens by one method, such a variable material as fæces naturally allows only rough approximation.

Methods.

The methods employed were as follows:

1. Preparation of a 5% to 10% suspension of fæces in broth and immediate inoculation of three MacConkey plates in series (direct MacConkey method).

2. Inoculation with undiluted fæces of three plates of "Difco" Wilson-Blair medium in series (direct Wilson-Blair method).

3. Preparation of a 5% to 10% suspension of fæces in Leifson's[(1)] selenite-F broth,[1] and after twenty-four hours' incubation at 37° C., subculture on three MacConkey plates in series (Leifson-MacConkey method).

4. Similar to the third method, but subculture was made on three Wilson-Blair plates in series (Leifson-Wilson-Blair method).

5. Preparation of a 5% to 10% suspension of fæces in Muller's tetrathionate broth (Hynes[(6)]), and after twenty-four hours' incubation at 37° C., subculture on three MacConkey plates in series (tetrathionate-MacConkey method).

6. Similar to the fifth method, but subculture was made on three Wilson-Blair plates in series (tetrathionate-Wilson-Blair method).

Technique of Inoculations.

Suspensions of fæces were made with a stout platinum wire or solid glass rod.

MacConkey plates were inoculated with one loopful (1·5 millimetres in diameter) of suspension on the first plate, distributed with a glass spreader, which was then used to inoculate the second and third plates in series.

Wilson-Blair plates were similarly inoculated from Leifson's medium, two loopfuls of suspension being used on the first plate. For direct inoculations a loopful of solid fæces was rubbed over the first plate with a glass spreader, which was then used to inoculate the second and third plates. Owing to a wartime shortage of four-inch Petri dishes, two-inch dishes containing ten cubic centimetres had to be used for this medium. Two four-inch plates

[1] Leifson's selenite-F medium is as follows: sodium hydrogen selenite (anhydrous), 0·4%; sodium phosphates (anhydrous), 1·0%; peptone, 0·5%; lactose, 0·4%; pH, 7·0 ± 0·1. It is important to determine experimentally the exact proportions of monosodium phosphate and disodium phosphate which together with the particular kind of peptone will give a final pH of about 7·0. We used Witte's peptone and phosphates in the proportion of 0·8% disodium phosphate and 0·2% monosodium phosphate. The components are dissolved in distilled water; the medium is put into tubes to a depth of at least two inches, and sterilization by steaming is carried out for thirty minutes.

may be used in preference to three two-inch plates. It is desirable to obtain well-separated colonies. The "Difco" Laboratories suggest inoculating one plate with fæces and a second with diluted fæces. Gunther and Tuft[6] prefer to streak undiluted fæces on each of two plates.

Identification of Bacterium Typhosum.

MacConkey plates were examined after twenty-four hours' incubation. Suspicious colonies which did not ferment lactose were subcultured on agar and identified by agglutination with specific antiserum. In the absence of agglutination, fermentation tests were made. On several occasions a motile bacillus producing acid but no gas in glucose and mannite was isolated, but subsequently proved to be a late lactose-fermenter.

Wilson-Blair plates were examined after forty-eight hours' incubation. Colonies of *Bacterium typhosum* were usually characteristic, being black surrounded by a lustrous metallic halo on the medium. Under the low power of the microscope these colonies appeared dull and flat. Blackening apparently commences in the middle of the colony and spreads to the edge, for colonies of various sizes with black centres were seen. Gunther and Tuft stated that on plates crowded with *Bacterium typhosum* colonies the majority might remain green, while only a few at the edge of the plate became blackened; this was sometimes our experience. We found, however, that while typical black colonies were often well isolated, they were occasionally closely surrounded by green colonies. Moreover, well-isolated colonies sometimes remained green, although when they were replated on Wilson-Blair medium they produced black colonies. We are unable to account for these phenomena.[1] Some black colonies were nearly always produced when *Bacterium typhosum* was cultivated from the fæces, and the green colonies were themselves rather characteristic. We investigated many different types of colonies and soon had no difficulty in distinguishing those of *Bacterium typhosum* from others. There are a few organisms, such as *Bacterium paratyphosum* B and *Bacterium enteritidis* (which we did not encounter), which produce colonies similar to those of *Bacterium typhosum* (Gunther and Tuft). Some reducing, lactose-fermenting bacilli give black colonies; but those we have seen were unlike *Bacterium typhosum* colonies. It is necessary to subculture suspected colonies on agar and to prove their identity by agglutination with specific antiserum.

The use of Wilson-Blair plates usually involves less work in identifying the organism than does MacConkey's medium, owing, firstly, to the characteristic colonies produced on the former, and, secondly, to its selectivity, many organisms being completely inhibited. On several occasions inoculation on Wilson-Blair plates from Leifson's medium yielded no growth, while subcultures on MacConkey plates contained coliform bacilli.

Experimental Findings.

In comparisons of media much depends on the material cultivated. If results include a large number of tests on material which does not contain the organism sought, not only is the proportion of positive results diminished, but differences between media are obscured.

In our series fæces were not usually examined until convalescence, and, as was expected, most specimens gave negative results to every test. It seems reasonable to accept these as true negative results and to omit them from the comparative table. For example, sixty specimens were inoculated directly on MacConkey plates and *Bacterium typhosum* was cultivated from twelve. Thirty-four of the negative results are excluded from Table III because they were from patients in whose fæces *Bacterium typhosum* was not demonstrated at that time or later. Thus the proportion of successes with the "direct MacConkey" method becomes 12 out of 26 instead of 12 out of 60. Or it may be stated that in 60 trials this method gave 34 true negative results, 12 positive results and 14 "false negative" results. The term "false negative" includes: (*a*) those results obtained with a specimen which yielded typhoid bacilli by another method; (*b*) those results obtained with a specimen (yielding no typhoid bacilli by other methods if tested) which was followed by a specimen from which typhoid bacilli were cultivated.

TABLE III.

Comparison of Methods in Cultural Examination of Faces.

Method.	Number of Specimens.	Positive Results.	"False Negative" Results.		Percentage of Positive Results.
			(*a*)	(*b*)	
Direct MacConkey ..	26	12	7	7	46
Direct Wilson-Blair ..	48	38	7	3	80
Leifson-MacConkey ..	43	22	11	10	51
Leifson-Wilson-Blair ..	33	29	2	2	88
Tetrathionate-MacConkey	12	2	9	1	17
Tetrathionate - Wilson - Blair	11	4	6	1	36

This latter group includes failures due to inadequacy of methods and to possible intermittency in the excretion of bacilli. While it is widely held that typhoid bacilli may be excreted intermittently (Browning *et alii*[7]), there is no doubt that detection of the organisms depends largely on the methods used (Holt and Wright[8]). We have therefore assumed that *Bacterium typhosum* was present in the earlier specimen, but not detected. This assumption is supported by the fact that in our series the incidence of "false negative" results was lowest with the better methods.

Our results are given in Table III; they demonstrate the superiority of the Leifson-Wilson-Blair method and the direct Wilson-Blair method. These two methods were tested in parallel on 31 specimens with the following results: both results positive, 23; only Leifson-Wilson-Blair results positive, six; only direct Wilson-Blair results positive, two.

It will be seen from Table III that the Leifson-Wilson-Blair method gave better results than the Leifson-MacConkey method.

The tetrathionate broth favoured the multiplication of *Bacillus proteus*, and our results discouraged its further use. Since this work was done, an excellent article on tetrathionate media has been published by Knox, Gell and Pollock.[9] They describe a tetrathionate medium which they believe will be much more effective than others.

During the course of the epidemic, to conserve special media the first clearance tests on a number of fæces specimens were made by direct inoculation of MacConkey plates. Subsequent tests on the first group of patients were made by enrichment in Leifson's selenite-F medium from which MacConkey plates were inoculated twenty-four hours later. At this time we lacked complete confidence in the Wilson-Blair medium, although we were commencing to use it for direct inoculation with fæces. Finally we made comparative tests, the results of which are given above, which have led us to adopt the following methods as a routine measure: (i) direct inoculation of fæces on Wilson-Blair plates; (ii) enrichment in Leifson's selenite-F medium followed by inoculation of Wilson-Blair plates.

Our work was based on the report of Gunther and Tuft[6] and confirms their findings. In 1923 Wilson[10] suggested a sulphite medium, which subsequently in conjunction with Blair he altered and improved.[11][12][13] Difficulty in preparing consistently dependable batches of this medium has deterred many workers from using it, although modifications by de Loureiro[14] may have simplified the process.

The "Difco" dehydrated product was put on the market about 1936, and consistently good results from its use have been reported by de Loureiro and by Hynes[5] as well as by Gunther and Tuft and ourselves. Its advantages

[1] Since this work was carried out, an abstract has been found describing experiments conducted by the Medical Research Council.[15] The authors observed that some batches of "Difco" Wilson-Blair medium were deficient in iron. They found that "the addition of 0·015% of ferrous sulphate to the Difco medium (1·5 ml. of a 1 per cent. solution of $FeSO_4.7H_2O$ to 100 ml. bismuth sulphite agar, Difco, when ready for pouring plates) was sufficient to enhance and hasten blackening of colonies of Bacterium typhosum without interfering appreciably with the selectivity of the medium".

are as follows: (i) it is stable and easy to prepare; (ii) a large inoculum (undiluted fæces) may be used; (iii) characteristic black colonies of *Bacterium typhosum* are produced. Its disadvantages are its expense, possible difficulties of obtaining supplies, and the fact that occasionally the *Bacterium typhosum* colonies do not turn black. In our opinion the medium is invaluable, particularly in laboratories in districts where the incidence of typhoid fever is usually low and irregular.

Cultural Examination of Urine.

Cultural examinations of urine of all patients were made, the criterion for discharge from hospital being three consecutive negative results at intervals of from four to seven days.

Gunther and Tuft compared two methods of culture; two cubic centimetres of urine were added to broth and ten cubic centimetres of urine were added to double strength selenite-F medium; after twenty-four hours' incubation both were streaked on Wilson-Blair medium. *Bacterium typhosum* was cultivated from 11 of 200 specimens, the organism being found by both methods on three occasions, and in broth only on eight occasions.

Our method was to add five cubic centimetres of a first morning specimen (catheter specimens were obtained from females) to fifty cubic centimetres of Hartley's tryptic broth. Inoculated media were examined after twenty-four and forty-eight hours' incubation; when Gram-negative bacilli were present subcultures were made on MacConkey's agar and occasionally on Wilson-Blair plates. The latter medium might be expected to give more reliable results in rare cases in which many coliform and a few typhoid bacilli were together in the broth culture.

As usual, *Bacterium typhosum* was identified by agglutination with specific antiserum. The organism was cultivated from urine only twice. No urinary carriers were detected.

Agglutination Tests.

"H" and "O" Agglutination.

In view of the successful cultivation of *Bacterium typhosum* from the blood of 44 of the 50 patients, Widal tests were usually not required for diagnosis. However, in four cases a positive response to the Widal test was the only laboratory evidence of typhoid fever obtained.

The antigens used were suspensions in 0·2% formol saline solution of an eighteen-hour growth on agar of the strains *Bacterium typhosum* H901 and 0901, *Bacterium paratyphosum* A-HA6, *Bacterium paratyphosum* B-HB2 and *Bacterium choleræ suis* var. *kunzendorf* 1350, adjusted by opacity to a strength of 800,000,000 organisms per cubic centimetre. Doubling dilutions of the serum were set up, an equal volume of suspension was added, and the tubes were incubated at 50° C. for two hours ("H" suspensions) and eighteen hours ("O" suspensions). The range of dilutions was from one in 20 to one in 640. The titre recorded corresponded to the dilution in the last tube showing definite agglutination visible to the naked eye. The suspensions H901 and O901 were compared with suspensions obtained from two other laboratories and known to compare with Oxford standard suspensions. Our "O" suspension was equal in agglutinability to these, but the "H" suspension used in most of the work was agglutinated only to half-titre, and this factor has been used in the recording of titres.

A titre of one in 80 for H or O agglutinins was accepted as a positive result. In a previous publication[2] some results have been recorded; 35 out of 46 specimens of serum tested gave positive "H" agglutination and 24 out of 47 positive "O" agglutination. Since that time further specimens have been examined and the final results are as follows. Of 49 patients tested, the serum of 22 showed both "H" and "O" agglutination, that of 17 (including the only two vaccinated patients in our series) showed "H" but no "O" agglutination, and that of 10 showed "O" but no "H" agglutination. When a positive result was obtained no further tests were made on that patient, so that the two last figures should not be taken to indicate that the second agglutinin never developed in those patients. However, our figures confirm the desirability of performing both tests, and we are convinced of the necessity for using standardized suspensions.

No agglutinins of the "H" type for *Bacterium paratyphosum* A, *Bacterium paratyphosum* B or *Bacterium choleræ suis* were observed except in serum from vaccinated patients. However, 30 out of 39 uninoculated patients whose serum was tested with these three antigens had formed "O" agglutinins to one or more of them. Details are set out in Table IV.

TABLE IV.
"O" Agglutinins.[1]

T.	T.A.B.C.	T.A.B.	T.B.	A.B.	B.C.	B.	None.
6	2	7	12	4	1	4	3

[1] T. = *Bacterium typhosum*; A. = *Bacterium paratyphosum* A; B. = *Bacterium paratyphosum* B; C. = *Bacterium choleræ suis.*

"Vi" Agglutination.

The existence of "H" and "O" antigens in the typhoid bacillus has long been established. In 1934 Felix and Pitt[15] showed that highly virulent strains contained a third antigen, which they called the virulence or "Vi" antigen. Such strains were inagglutinable by "O" serum, and active and passive immunization disclosed a highly protective action of "Vi" antibody. Subsequently it was shown that most freshly isolated strains of *Bacterium typhosum* contained some "Vi" antigen. In the preliminary experiments of Felix and his co-workers, the highly virulent strain "Watson" was used for estimating "Vi" antibody in human serum. This involved either the difficult task of reading "Vi" agglutinations in the presence of "H" and "O" agglutination, or removal of "H" and "O" agglutinins by absorption of serum with a typhoid strain such as H901 which contained no "Vi" antigen.

However, in 1938 Bhatnagar *et alii*[16] described a strain isolated from the urine of a carrier, which behaved as a pure "Vi" variant, in that it gave complete agglutination with pure "Vi" serum, no agglutination with "H" serum and only a trace with "O" serum. This strain was designated "Vi 1" and is more suitable than strain "Watson" for titrating "Vi" antibody in serum. The titre of "Vi" antibody is usually much lower than those of "H" and "O" antibodies, and readings as low as one in five are regarded as important (Felix[17]).

Recent work has been directed towards a study of the significance of "Vi" antibody, especially its development in the course of typhoid fever, its value in diagnosis and prognosis and its persistence in patients who have recovered and in carriers.

In 1938 Bhatnagar[18] examined the serum of 134 patients suffering from typhoid fever. Strain "Vi 1" was used, and the antibody was estimated usually every fourth day. All the patients were found to have a maximum "Vi" titre in their serum of at least one in 25, "Vi" antibody being detected as early as the third day in some cases.

In a series of 80 patients, Benstead,[19] using strain "Vi 1" and serum dilutions from one in 20, reported a complete absence of "Vi" antibody in 19. Five of the 19 were tested in serum dilutions from one in five from the third day onwards throughout the illness. Of the remaining 61 patients, appreciable titres were found in the serum of 18 before the end of the first week, and in that of 43 between the period from the eighth to the twenty-first day.

Felix *et alii*,[20] in a series of thirteen patients, could find no constant relationship between the clinical course of the disease and the appearance or titre of "Vi" antibodies in the patient's serum. Bhatnagar,[21] however, analysed 280 cases into six clinical types and related them to the laboratory findings. In the "simple" type "Vi" agglutinins appeared early in the disease, the course of which was short; in the severe types "Vi" agglutinins either did not appear at all, when the outcome was often fatal, or appeared late in the disease and were associated with clinical improvement.

Both Bhatnagar[18] and Benstead[19] have shown that detectable amounts of "Vi" antibody may disappear from the blood within three weeks of their first appearance. In 1935 Felix and his co-workers[20] discovered a chronic carrier, whose serum had a "Vi" titre of one in 20, and suggested that "Vi" agglutination tests might be of value in identifying carriers. Subsequently Felix[17] examined serum from 58 chronic carriers and observed positive "Vi" agglutination in serum from 56. Similar observations concerning chronic carriers were made by Pijper and Crocker,[22][23] by Bhatnagar,[18] by Eliot[24] and by Benstead.[19]

It is of interest that three months after cholecystectomy, the serum of one of Benstead's chronic carriers had retained a "Vi" titre of one in ten, in spite of repeated failure of the fæces to yield cultures of typhoid bacteria. Benstead also examined serum from four temporary carriers who were excreting typhoid bacilli more than a month after convalescence was complete. In two instances a secondary rise in "Vi" titre during convalescence was found; in the others no "Vi" antibody was present while typhoid bacilli were being excreted, although it had been present in low titre during the early part of the illness. In another case of Benstead's, during convalescence a rise in "Vi" titre from zero to one in 160 occurred, beginning two months after the onset of the disease and nearly three weeks after full convalescence had set in. In spite of examination of over sixty specimens of urine and fæces by direct and enrichment methods, it was not possible to demonstrate a carrier condition.

With regard to the presence of "Vi" antibody in the serum of persons with no history of typhoid fever, reports are conflicting. Both Davis[25] and Rodowsky,[26] working with large groups of native sera in Rhodesia, found "Vi" agglutinins in more than 5%. Bhatnagar,[18][21] however, stated that in the examination of thousands of specimens of serum from both inoculated and uninoculated persons no "Vi" antibody was detected; its presence had always been found associated with the existence of *Bacterium typhosum* in the body, and observations to the contrary were mainly due to non-specific reactions likely to arise when unsatisfactory suspensions of strain "Vi 1" were used.

In 1938 Felix[17] had observed "Vi" antibody in the blood of five out of 100 female patients in a mental hospital. He suggested that those whose serum contained "Vi" agglutinins and who were not excreting typhoid bacilli were harbouring them. He cited a case of empyema due to *Bacterium typhosum*, which developed in a man who had suffered from typhoid fever forty years previously.

"Vi" agglutinins may develop in a proportion of vaccinated persons varying with the type of vaccine used (Felix *et alii*[27]). It is possible also that they may be developed or increased in the course of certain febrile diseases other than typhoid fever. Thus Benstead[19] detected them in the serum of six out of ten inoculated persons suffering from typhus fever. There was no confusion in diagnosis, as agglutinins for *Bacillus proteus* OXK were also present and increased in titre throughout the disease.

Experimental Findings.—The antigen used was a suspension in 0·2% formol saline solution of a twenty-four hour growth on agar of *Bacterium typhosum* strain "Vi 1" adjusted to an opacity of 800,000,000 organisms per cubic centimetre. Doubling dilutions of the patient's serum in saline solution were set up and an equal volume of suspension was added, so that the range of dilutions was from one in five to one in 160. The test material was incubated at 37° C. for two hours, and the results were read after it had stood on the bench overnight. The suspension was tested against a sample of Felix's provisional standard serum before and after the tests were carried out, both reagents being stored in the refrigerator when not in use. With a one in 600 dilution of Felix's serum the suspension gave a reading corresponding to what would be recorded for agglutinations of the "H" or "O" type as "+++", but in accordance with Felix's directions this was taken as the end-point, and lower degrees of agglutination are not discussed. Dilutions of "Vi 1" antiserum, which had been compared with Felix's serum, were used to control the tests. The specimens of serum were stored in the refrigerator for periods varying from a few days to over twelve months, when they were tested in batches, the whole series of tests being carried out within a short time. Agglutination occurring in a one in five dilution of the patient's serum and equal to that given by a one in 600 dilution of Felix's serum, was considered significant.

Serum was obtained from 49 epidemic patients during their illness. Few specimens were collected before the eighteenth day of disease, and from most patients only two or three specimens were taken. However, "Vi" antibody was found in the serum of twenty patients. It appears that the chance of finding "Vi" antibody in any single specimen of serum is too small to make the test of value in diagnosis. We have no observations relevant to Bhatnagar's suggestion as to its use in prognosis, but we have investigated the persistence of agglutinins in the serum of recovered patients and in carriers.

Serum was obtained from 44 epidemic patients and from three other patients at the time of their discharge from hospital, and eight specimens contained "Vi" agglutinins. Two of the reactors were carriers. Of the other six, two were last examined six weeks after their discharge from hospital, and four were reexamined from five to fifteen months later. The serum titres last observed were one in five, one in five, one in ten, one in ten, one in twenty and one in five. Urine and fæces were examined at the same time as the serum and no typhoid bacilli were found.

Six people were transferred to another hospital while still excreting typhoid bacilli. Three became free from infection within three months. Serum from two of them was examined, with negative results, at the height of disease, at the time of transfer and after their discharge from another hospital. The serum of the third patient had a "Vi" titre of one in five in early convalescence; after his discharge from hospital no "Vi" agglutinins could be demonstrated.

In addition to the samples of serum collected from the three chronic carriers treated here, we examined serum from five others, four from the Moorabbin epidemic and one from a small outbreak at Mansfield. Six of these eight carriers had "Vi" agglutinins in their serum, the titres of the most recent specimens being one in five, one in five, one in 40, one in 80, one in 160 and one in 160. One of the two carriers whose serum did not react was tested on only one occasion some months after her discharge from another hospital. The other was tested on five occasions; serum collected on the nineteenth day of illness had a titre of one in five; samples taken during convalescence and since have not contained agglutinins, although the fæces remain loaded with *Bacterium typhosum*.

Our findings are therefore in accord with those reported in other countries; "Vi" agglutinins are formed in the course of the disease by many patients; few recovered patients retain them. The suggestion that such people harbour *Bacterium typhosum* without excreting it is one which may take many years to establish. Most carriers have demonstrable amounts of "Vi" agglutinins, and while the test is not conclusive for the carrier state, it is rapid and capable of application to large numbers of "suspects".

Summary.

The occurrence of a typhoid epidemic provided the opportunity to assess methods in use at a hospital laboratory.

The convenience to the bacteriologist of diagnosis by an adequate method of cultural examination of the blood is made evident. Forty-four out of fifty cases were diagnosed by culture from the blood. The use of two media, and repeated attempts to cultivate the organism from the blood, are shown to be of value. Excellent results were obtained with Wright's broth containing trypsin.

Comparisons of six methods of making cultural examinations of fæces demonstrated the superiority of two—namely, direct plating on "Difco" Wilson-Blair medium, and enrichment in Leifson's selenite-F medium followed by inoculation of Wilson-Blair plates. The use of "Difco" Wilson-Blair medium in districts where typhoid fever occurs sporadically is urged.

The examination of the urine by cultural methods is described.

In agglutination tests the necessity for testing for both "H" and "O" agglutinins and for using standard suspensions is stressed.

Tests for "Vi" agglutinins have been performed, with results in accord with those of other workers. The chief value of the test is in the detection of carriers. Agglutinins were demonstrated in the blood of six out of eight carriers examined. In the serum of many patients "Vi" agglutinins developed in the course of the disease, but few non-carriers retained them in convalescence.

Details of methods and technique are given.

Acknowledgements.

These investigations could not have been carried out without the ready and active cooperation of Dr. C. Conway Dyte, Medical Superintendent, and of Sister C. Webster, who was in charge of the typhoid ward.

Our thanks are also due to Dr. W. J. Allen for permission to obtain specimens from the carriers under his care, and to Flight-Lieutenant G. Gibson for collecting some of the specimens.

A Request.

An interesting development from the work on "Vi" antigens is the discovery by Craigie and Yen (1938) of a bacteriophage active against "Vi"-containing strains of typhoid bacilli. This bacteriophage readily produces variants highly specific for different strains, and by its use a number of types have been distinguished. The information obtained may prove the connexion between a carrier and an epidemic. One of us (G.B.) is at present typing all available strains of *Bacterium typhosum* and would be grateful to receive cultures, either now or at any future time, when cases of typhoid fever occur.

References.

(1) C. R. Merrillees: "Report on Typhoid Fever in the City of Moorabbin, 1943", Special Report of Victorian Public Health Department.

(2) "Bacteriological Report on Epidemic of Typhoid Fever in the City of Moorabbin, 1943", *Health Bulletin*, Numbers 75 and 76, 1943, page 2019.

(3) H. M. Butler: "Blood Cultures and their Significance", *Monographs of the Baker Institute of Medical Research*, Number 3, 1937.

(4) E. Leifson: "New Selenite Media for the Isolation of Typhoid and Paratyphoid (Salmonella) Bacilli", *The American Journal of Hygiene*, Volume XXIV, 1936, page 423.

(5) M. Hynes: "The Isolation of Intestinal Pathogens by Selective Media", *The Journal of Pathology and Bacteriology*, Volume LIV, 1942, page 193.

(6) C. B. Gunther and L. Tuft: "A Comparative Study of Media Employed in the Isolation of Typhoid Bacilli from Feces and Urines", *The Journal of Laboratory and Clinical Medicine*, Volume XXIV, 1938-39, page 461.

(7) C. H. Browning, H. L. Coulthard, R. Cruickshank, K. J. Guthrie and R. P. Smith: "Chronic Enteric Carriers and their Treatment", Medical Research Council of the Privy Council, Special Report Series Number 179, 1933.

(8) H. D. Holt and H. D. Wright: "Paratyphoid Carriers: The Infectivity of the Fæces and the Failure of Chemotherapy with Sulphapyridine and Iodophthalein", *The Journal of Pathology and Bacteriology*, Volume LIV, 1942, page 247.

(9) R. Knox, P. G. H. Gell and M. R. Pollock: "The Selective Action of Tetrathionate in Bacteriological Media: A Report to the Medical Research Council", *The Journal of Hygiene*, Volume XLIII, 1943, page 147.

(10) W. J. Wilson: "Reduction of Sulphites by Certain Bacteria in Media Containing a Fermentable Carbohydrate and Metallic Salts", *The Journal of Hygiene*, Volume XXI, 1922-23, page 392.

(11) **W. J. Wilson and E. M. McV. Blair: "Use of a Glucose Bismuth Sulphite Iron Medium for the Isolation of B. Typhosus and B. Proteus"**, *The Journal of Hygiene*, Volume XXVI, 1927, page 374.

(12) W. J. Wilson and E. M. McV. Blair: "Further Experience of the Bismuth Sulphite Media in the Isolation of Bacillus Typhosus and B. Paratyphosus B. from Fæces, Sewage and Water", *The Journal of Hygiene*, Volume XXXI, 1931, page 138.

(13) W. J. Wilson: "Isolation of Enteric Bacilli from Sewage and Water and its Bearing on Epidemiology", *British Medical Journal*, Volume II, 1933, page 560.

(14) J. A. De Loureiro: "A Modification of Wilson and Blair's Bismuth Sulphite Agar (Stabilized Stock Solutions)", *The Journal of Hygiene*, Volume XLII, 1942, page 224.

(15) A. Felix and R. M. Pitt: "A New Antigen of B. Typhosus: Its Relation to Virulence and to Active and Passive Immunization", *The Lancet*, Volume II, 1934, page 186.

(16) S. S. Bhatnagar, C. G. J. Speechly and M. Singh: "A Vi Variant of Salmonella Typhi and its Application to the Serology of Typhoid Fever", *The Journal of Hygiene*, Volume XXXVIII, 1938, page 663.

(17) A. Felix: "Detection of Chronic Typhoid Carriers by Agglutination Tests", *The Lancet*, Volume II, 1938, page 738.

(18) S. S. Bhatnagar: "Vi Agglutination in the Diagnosis of Typhoid Fever and the Typhoid Carrier Condition", *British Medical Journal*, Volume II, 1938, page 1195.

(19) H. J. Benstead: "Bacterium Typhosum", *Journal of the Royal Army Medical Corps*, Volume LXXIV, 1940, page 19.

(20) A. Felix, K. S. Krikorian and R. Reitler: "The Occurrance of Typhoid Bacilli Containing Vi Antigen in Cases of Typhoid Fever and of Vi Antibody in their Sera", *The Journal of Hygiene*, Volume XXXV, 1935, page 421.

(21) S. S. Bhatnagar: "Prognostic Value of Laboratory Investigations in Typhoid Fever", *British Medical Journal*, Volume I, 1944, page 417.

(22) A. Pijper and C. G. Crocker: "The Agglutinins of Typhoid Carriers", *The Journal of Hygiene*, Volume XXXVII, 1937, page 332.

(23) A. Pijper and C. G. Crocker: "Typhoid Carriers and Vi Agglutinins", *The Journal of Hygiene*, Volume XLIII, 1943, page 201.

(24) C. P. Eliot: "The Vi Agglutination Test as an Aid in the Detection of Chronic Typhoid Carriers", *The American Journal of Hygiene*, Volume XXXI, 1940, Section B, page 8.

(25) L. J. Davis: "The Distribution and Significance of Typhoid Vi Agglutinins in Normal Sera of African Natives", *The Journal of Hygiene*, Volume XL, 1940, page 406.

(26) H. Radowsky: *Transactions of the Royal Society of Tropical Medicine and Hygiene*, Volume XXXVI, 1942, page 45; cited by Pijper and Crocker, *loco citato*, 1943.

(27) A. Felix, S. G. Rainsford and E. J. Stokes: "Antibody Response and Systemic Reactions after Inoculation of a New Type of T.A.B.C. Vaccine", *British Medical Journal*, Volume I, 1941, page 435.

(28) Medical Research Council: "Note on Bismuth Sulphite Agar (Difco)", *Monthly Bulletin of the Emergency Public Health Laboratory Service*, Volume II, 1943, page 28; abstracted in *The Bulletin of Hygiene*, Volume XVIII, Number 6, 1943, page 504.

THE PROBLEM OF SELECTION OF MEDICAL STUDENTS FOR ADMISSION TO THE QUOTA FOR THE MEDICAL COURSE.

By E. S. MEYERS,
Brisbane.

PRIOR to the introduction of man power regulations as an important feature of the Australian war effort, medical students were admitted to the medical faculties of Australian universities on passing the prescribed medical matriculation examination. With the coming of the "quota" system, the right of entry to the medical faculty was determined for the first time in the history of Australian universities by a competitive examination.

Whether it is a good thing or not is a subject beyond the scope of this article; but it seems likely, owing to inadequacy of accommodation alone, that the quota system will remain in force for some years. If this is so, the question of the best method of selection under the quota system is likely to be a subject of interest, not only to the medical profession, but also to others. The Leaving Certificate or similar examination has served as the test to determine on a competitive basis, according to the number of marks obtained in certain specified subjects, the right of a candidate to be included in the quota.

Many medical practitioners consider that the criterion of examination marks alone is not the best method of selecting future members of the medical profession. Some of those who defend this method quote an article by Dr. F. S. Cotton[1] in support of their advocacy of the present system. Dr. Cotton states, from an analysis of the matricu-

lation results of 370 medical students in relation to success at subsequent examinations, that approximately the weaker 30% are responsible for more subsequent failures than the better 70%. In other words, of 100 students, divided into a stronger 70 and weaker 30, 16 of the stronger 70 against 18 of the weaker 30 would fail. The protagonists of the marks system reason as follows: "Seeing that, under the present conditions of war, it is necessary for students to qualify in the shortest possible time, what better system could you have than the present system?"

In the selection of students in some universities, mathematics and science subjects carry more marks than the so-called cultural subjects, and here again Dr. Cotton has been quoted in support. He brings figures to show that students who have passed in a science subject for matriculation have much more success than those who have not done so. The "pass to fail" ratio is greater than three.

It may be of interest to consider some of the arguments that have been used by those who think that it is possible to improve upon present methods of selection. In the first place, it is obvious that if we could devise a system of selection that excluded the majority of failures that occur in the case of the better 70% and included the majority of passes among the weaker 30%, we should have not only a more efficient system, but a fairer one.

Quite a number of people think that in all cases Dr. Cotton's deductions do not strictly follow from his figures. For example, he makes the following statements: (i) a student who possesses the type of mind likely to do well in medicine is more likely to be interested in choosing a science subject at school; (ii) the fact that he takes a science subject helps him later in medicine by steady development of a point of view which is described as a scientific outlook, but which includes some developing judgement on the nature of valid evidence; (iii) much study of language subjects develops certain tendencies and habits of mind inclining the student to rely for his mastery of examination subjects more upon sheer memory and adherence to rules than upon logical reasoning and consideration of evidence.

Criticisms of these deductions are as follows. (i) "The type of mind likely to do well in medicine" is likely to be found in more places than in the medical faculty. It may occur in other faculties where the students have chosen non-science subjects, or it might occur in cases in which circumstances prevent any choosing at all. It is further deduced by some that a student desirous of studying medicine (not necessarily likely to do well) will tend to choose a science subject to smooth the early stages of his course. (ii) This hinges upon the validity of the analysis. Presumably better science students enter science faculties rather than arts faculties, while better students in languages and history go into arts, law *et cetera*. Consequently it is possible that, of those students whose results are examined by Dr. Cotton, the science group is better at science than the language and history group is in its field. No analysis was made of matriculation results from which this could be determined. (iii) "Scientific outlook", "habit of mind and work", "memory *versus* reason"—all these arguments can be refuted in many cases from one's own experience of many students. Only the best students in mathematics and science possess any logical handling of the subject or scientific outlook, while many language and history students (especially language students) must use logic and memory, both equally essential throughout the medical course.

Number of medical students listed in first-year medicine (1909 calendar)	125	
Number of medical students commencing first year for the first time	109	
Number of students who matriculated at the Senior Examination, 1908	32	83
Number of students who matriculated at the Matriculation Examination, 1909	51	
Number of students who matriculated at the Senior Examination, and completed the medical course in five or five and a half years	25	
Number of students who matriculated in February, 1909, and completed the medical course in five or five and a half years	30	
Percentage of passes amongst matriculants at the Senior Examination, 1908	78	
Percentage of passes amongst matriculants in February, 1909	59	
Number taking a science subject amongst the 32 matriculants at the Senior Examination	16	
Number who took no science subject	16	
Number who took a science subject, and completed the medical course in five or five and a half years	15	
Number taking no science subject, who completed the medical course in five or five and a half years	10	

At this juncture reference is made to the foregoing tabulation, which has been compiled from official publications of the University of Sydney and which, even though coming under the heading of what, in many quarters, is looked on with some derision as "ancient history", nevertheless has a bearing on the problem that is being discussed. For a number of years before and after 1908, students of the University of Sydney were able to enter the faculty of medicine by satisfying the matriculation requirements, either by passing the Senior Examination at the end of the year or by passing the special Matriculation Examination held in the following February. For the most part, better students were found amongst the candidates for the Senior Examination, weaker students, in the main, taking the February Matriculation Examination.

The tabulation shows that 83 candidates who were enrolled for the first time as students in the first year of the faculty of medicine, may be divided into three categories: (i) those who matriculated at the Senior Examination and took one science subject; (ii) those who matriculated at the Senior Examination and took no science subject; (iii) those who matriculated at the special February Matriculation Examination and took no science subject. Sixteen students were in the first group, and 15 completed the medical course in five or five and a half years. In the second group there were 16 students, and 10 completed the course in the same time. In the third group there were 51 students, and 30 similarly completed the course. Thus it will be seen that these figures resemble those of Dr. Cotton.

Had the quota system been in operation in 1909, and had we been able to exclude the better students who failed and to include the poorer students who passed, we should have had 100% completing the course in the minimum possible time. It is, of course, realized that it would be extremely difficult to devise any system that would give a result like this; but it is thought that we shall have to do better than to rely wholly on scholastic competition. In the first place, one would have to be a statistician to know whether we require to have hundreds, thousands or tens of thousands of cases, if we were justified in making deductions from bare figures. Then again, it is extremely dangerous practice to apply statistical methods to human material. In this method it is obvious that we lack the necessary control; for example, in making comparisons we have no knowledge, even with regard to students of similar groups of good, average and poor students, as to their intelligence, their industry, the quality of instruction necessary or the conditions of study. This criticism applies, not only to Dr. Cotton's figures, but also to the figures given in the tabulation.

The critics of the marks system make this further comment—and it is a point of view that does not appear in Dr. Cotton's article: academic success does not necessarily mean that a student will prove to be a good doctor. Conversely, quite a number of students who do not do well in examinations make very good doctors.

Table I, which is compiled from official publications, such as the Queensland and New South Wales lists of registered medical practitioners, lists of members of the Royal Australasian Colleges of Physicians and Surgeons, and "Knox's Medical Directory" for 1940, shows the type of practice in which are engaged the 25 students who matriculated from the Senior Examination in 1908, and those 30 who matriculated at the special Matriculation Examination in 1909. Apart from a few possible errors and omissions, the information is correct. Had there been a quota system in force in 1909 and a system of selection

TABLE I.

Present Kind of Practice in which 55 Students Entering the Medical Faculty in 1909 and Completing the Medical Course in 1914 are Engaged.

Type of Practice.	"Senior" Matriculants, 1908.	February Matriculants, 1909.
General practice	8	14
Social medicine	3	1
Surgery	4	8
Medicine	1	0
Oto-rhino-laryngology	1	2
Ophthalmology	1	1
Gynæcology	1	0
Dermatology	1	0
Radiology	0	1
Not on register[1]	5	3
Total	25	30

[1] "Not on register" includes some killed in action in the war of 1914–1918, some who have died of other causes, and some whose whereabouts are unknown.

corresponding to the present system, it would have been necessary to exclude many who matriculated. Furthermore, most of the students excluded would have been those who passed the special February Matriculation Examination—the so-called weaker students who matriculated in 1909 and completed their course in 1914, and who are now practising as specialists and general practitioners. The university publications do not show the order of merit of students in the February Matriculation Examination. In this group are a number of very good general practitioners and specialists, some with Australian and even world-wide reputations. It is quite possible that they would have been excluded from the medical course under the conditions mentioned.

There are two aspects of the present method of selection that call for special comment:

1. Many students who do not do well in the Matriculation Examination are those who have had to leave school at an early age and have the handicap of having to earn their living while their more fortunate competitors are able to remain at school until the age of eighteen or even nineteen years.

2. This aspect concerns the weighting of mathematics and science. It is agreed that it is to the advantage of the student to take these subjects at the Matriculation Examination, for, in addition to the figures quoted by Dr. Cotton, figures in the earlier tabulation show that such students do well. Then, too, for certain types of medical practice a good knowledge of mathematics and basic science is essential. On the other hand, a great many students with minimum ability in mathematics and basic science are able to complete their courses in the minimum possible time and, what is more important, many of them make excellent practitioners. Their aptitudes lie in directions other than towards academic ability.

We can sum up the whole matter thus: if we are to have students, even under war conditions, who will be of the greatest use to the nation in the shortest possible time, we must select those who not only have academic ability, but also possess aptitudes in other directions, which long experience has shown to be necessary for the efficient practice of medicine. It has been suggested that the following be taken into consideration in making selection for medical quotas: (i) scholastic ability as judged by performance, not only in the Matriculation Examination, but on the whole of the school record; (ii) reports from the headmaster or headmistress, not only on academic achievement, but also on the student's character, public service and participation in other school activities; (iii) result of tests of aptitude for manual ability; (iv) report of an interviewing committee specially selected for the purpose of interviewing and reviewing all the records of the students.

While no method of selection can be perfect, it is thought that the method suggested is better than one in which the line drawn between candidates admitted and excluded separates groups whose academic ability is practically equal.

Summary and Conclusions.

1. Some of the conclusions in Dr. Cotton's article are discussed.

2. Reasons are given as to the necessity for improved methods of selection of medical students under the quota system.

3. Improved methods of selection have been indicated. Such methods of selection have been used with success in the selection of candidates for commissions in the fighting services.

Acknowledgements.

I wish to thank Mrs. M. Macgregor, librarian of the Medical School, University of Queensland, and Pilot Officer D. H. Meyers, Royal Australian Air Force, for much help in preparing this paper.

Reference.

(1) F. S. Cotton: "An Inquiry into the Relationship between the Quality and Kind of Matriculation Passes of Medical Students and their Subsequent Success or Failure in the Various Annual Examinations", THE MEDICAL JOURNAL OF AUSTRALIA, September 24, 1938, page 491.

PHYSIOLOGICAL CONSIDERATIONS IN VASCULAR SURGERY: LIGATURE OF MAIN ARTERIES TO THE LIMBS.[1]

By LAMBERT ROGERS.

Surgeon Captain, Royal Naval Volunteer Reserve.
Surgical Consultant, British Pacific Fleet.

THERE is always an urge to apply physiological concepts to practice, and there can be few better opportunities than in the case of an injury to the main artery of a limb, the local peripheral circulation of which has consequently been placed in jeopardy. Repair of arteries under war or indeed under any conditions is but rarely possible. If it is assumed, therefore, that the main artery has to be tied, what steps should be taken to ensure minimal interference with the peripheral circulation? There are sound physiological reasons for the following, which have also proved effective in practice.

1. The artery should be secured in two places and divided between ligatures, rather than tied in continuity. Division permits the ends to retract and become securely closed, and may suppress a generalized vasospasm which may result from damaging but not dividing the main vessel. Moreover, embolism from the site of the ligature is less likely to take place from a divided vessel; nor is such a vessel likely to ulcerate and bleed, as has occasionally happened with arteries ligated in continuity.

2. The site at which the artery is ligated is important. If a segment of the vessel has been damaged, the injured length of artery should be resected. It is advisable to tie the artery just below a large branch, rather than to leave a blind end into which there is a blood flow with each pulse beat; for example, the femoral artery should be tied just below the origin of the profunda, rather than an inch or two lower in Hunter's canal. Furthermore, the distal ligature should also be placed near, that is, just above, a large branch, and the intervening part of the artery should be resected. For example, in the case of the brachial artery there is less interference with the circulation in the hand and fingers if the artery is tied just distal to the origin of the superior profunda and again just proximal to the origin of the inferior profunda, and the intervening part resected, than if the vessel is just tied and divided somewhere between the two branches. These considerations follow from the experimental work of Emile Holman, of San Francisco (1944).

3. The accompanying main vein should also be ligated. In the last war Sir George Makins regarded this as so important that he caused an Army order to be issued, to the effect that when it was necessary to ligate the main artery the accompanying vein should be tied also. Recent

[1] Remarks made on March 26, 1945, in opening a discussion on vascular injuries at a Royal Naval hospital.

experimental work (Holman, 1942) has shown the soundness of this. Laboratory animals show less impairment of their local peripheral circulation if the vein and artery are ligated than if the artery alone is tied.

4. Rapid transfusion of 800 to 1,200 cubic centimetres of blood, by increasing the blood pressure and forcing open capillaries, has proved valuable, and in this war has been practised with advantage by the German army. When ligature of a main artery produced extreme pallor, indicating impending necrosis, this rapid transfusion was found to save the limb (Bartholome, 1942).

5. The position of the limb is important. The position should be such that the circulation of the limb is aided to the fullest extent and not retarded by gravity. The optimum position, therefore, is one in which the limb is extended and supported at heart level.

6. In order to reduce to a minimum the demands made by the limb on the blood supply, its metabolism should be lowered by cooling. It has been shown (Barcroft and Edholm, 1943) that at 104° F. the amount of blood demanded by a muscle in normal circumstances of circulation is eighteen times that demanded at 77° F. The limb should therefore be cooled by being packed around with ice and the metabolism thereby slowed down while a collateral circulation is developing.

7. At the same time it is desirable to relax the peripheral vessels generally, and this can be accomplished by heating the body as a whole, for example, under an electric cradle.

Sympathectomy.

In acute vascular injuries sympathectomy is probably of less value than the measures advocated. At most, injection of the lumbar ganglia in the case of the lower limb is all that is desirable.

Danger of Arterial Occlusion in Arterio-Venous Communications.

In cases of arterio-venous communications, ligature of the main artery is to be avoided, as the shunt into the accompanying vein is so great and the peripheral circulation in consequence so depleted that arrest of the main blood flow will almost certainly produce gangrene. In arterio-venous communications, closure of the shunt, therefore, must also be instituted if the artery is tied, and this usually necessitates a quadruple ligature operation, the two main vessels being secured both proximally and distally to the communication between them.

If ligature of any main artery can safely be delayed, such delay is advisable, because it favours the development of a collateral circulation. In the case of arterio-venous communications, however, it must be remembered that in the course of time these lesions produce cardiac hypertrophy.

Summary.

If ligature of a main artery can be delayed, the development of the collateral circulation is enhanced. When it is necessary to ligate the main artery of a limb, the artery should be divided between ligatures at an appropriate site in relation to branches, the accompanying vein should be tied, a large blood transfusion given rapidly, and the limb placed at rest in extension at heart level. The body should be heated and the limb cooled with ice and kept cool.

In arterio-venous communications the main artery alone must not be secured. It is necessary to ligate both artery and vein above and below the anastomosis.

Bibliography.

H. Barcroft and O. G. Edholm: "Effect of Temperature on Blood Flow and Deep Temperature in Human Forearm", *The Journal of Physiology*, Volume CII, 1943, page 5.

H. Bartholome: *"Erfahrungen in der Behandlung der pyogenen- und putriden Wund- und Allgemeininfektion bei Kriegswunden"*, *Münchener medizinische Wochenschrift*, Volume LXXXIX, 1942, page 901.

E. Holman: "War Injuries to Arteries and their Treatment", *Surgery, Gynecology and Obstetrics*, Volume LXXV, 1942, page 183.

E. Holman: "Further Observations on Surgery of Large Arteries", *Surgery, Gynecology and Obstetrics*, Volume LXXVIII, 1944, page 275.

Reviews.

TROPICAL DISEASES.

WHEN the sixth edition of "Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases" was published in 1942, thirteen years had elapsed since the previous edition appeared. The enormous importance that had been acquired by tropical diseases was emphasized by the fact that from that period until the appearance of the seventh edition in October, 1944, these massive volumes had been reprinted in January, 1943, March, 1943, and December, 1943.

Professor Richard P. Strong, Emeritus Professor of Tropical Medicine in the Harvard University, and consultant to the Secretary of War and the Director of Tropical Medicine at the Army Medical School, Washington, D.C., has, in the present two volumes, enlarged and at the same time compressed the book in order to include a great mass of information obtained by field measures among tropical diseases in the south-west Pacific area and elsewhere.[1]

It was to be expected that the United Nations, deprived almost entirely of quinine supplies by the capture of the Dutch East Indies and the Federated Malay States by Japan, would have elaborated a substitute technique with synthetic drugs, and the admirable development from 1941 onwards of the therapeutics of this drug (first introduced in practice on this side of the world in New Guinea in 1925) has been of the greatest possible value to the war effort. It is doubtful, indeed, if without it our forces could have been maintained in Melanesia and further north. Strong, nevertheless, conserves the opinion (which those who have used quinine extensively will confirm) that quinine in experienced hands is probably still the best drug for the treatment of malaria. He has failed, however, perhaps to give the synthetic drugs their due, and the order in which he has arranged them ("Plasmoquine" first and "Atebrin" last) is hardly that which appeals to those who have seen the excellent results obtained by the meticulous use of "Atebrin" in New Guinea.

In respect of bacillary dysentery, due attention is given to sulphanilylguanidine (commonly known as sulphaguanidine), and the experience of Fairley and Boyd, 1942, with 271 cases in British and Australian troops in the Middle East, is mentioned. Reference is also made to the use from 1944 of sulphadiazine, based especially on the studies of Hardy, and the warning, issued by various authors, as to the dangers of the use of sulphadiazine in the tropics where large amounts of fluid are lost through the skin, with consequent renal complications, is not overlooked.

A page is added by the author to his treatment of plague by the inclusion of some references to the highly significant work upon sulphadiazine in respect of bubonic plague and plague septicæmia. The author's chief emphasis, however, until the matter is better defined, is upon symptomatic treatment, and the new methods are treated with caution.

In the treatment and prophylaxis of typhus, which he has dealt with in detail, his mention of D.D.T. (or gesarol) is somewhat disappointing. The experience in respect of the epidemic in south Italy may perhaps have justified somewhat more emphasis upon the revolutionary nature of this prophylactic and its effect upon body parasites.

Nevertheless, these criticisms are criticisms of minutiæ, and may indeed be merely expressions of varying opinion. The general excellence of the volumes is a matter about which there can be no question. Their binding and production leave little to be desired; their encyclopædic nature makes it possible to expect with confidence within their covers some reference to almost every work of importance upon tropical medicine recently published, and medical officer, student and research worker alike can find within them thoroughly complete and satisfying outlines upon practically every aspect of tropical work.

[1] "Stitt's Diagnosis, Prevention and Treatment of Tropical Diseases", by Richard P. Strong, M.D., Sc.D., D.S.M., C.B.; Seventh Edition, in two volumes; 1944. Philadelphia: The Blakiston Company. 9" × 6", Volume I, pp. 927, with many illustrations; Volume II, pp. 922, with many illustrations. Price: $21.00 per set.

The Medical Journal of Australia

SATURDAY, MAY 19, 1945.

All articles submitted for publication in this journal should be typed with double or treble spacing. Carbon copies should not be sent. Authors are requested to avoid the use of abbreviations and not to underline either words or phrases.

References to articles and books should be carefully checked. In a reference the following information should be given without abbreviation: initials of author, surname of author, full title of article, name of journal, volume, full date (month, day and year), number of the first page of the article. If a reference is made to an abstract of a paper, the name of the original journal, together with that of the journal in which the abstract has appeared, should be given with full date in each instance.

Authors who are not accustomed to preparing drawings or photographic prints for reproduction are invited to seek the advice of the Editor.

WOMAN AND THE POPULATION PROBLEM.

In the issue of February 10, 1945, reference was made in these pages to the decline of the birth rate as having been the most important item on the agenda of the eighteenth session of the National Health and Medical Research Council in November last. In that issue papers by several authors on the subject of sterility were published and emphasis was laid on the fact that sterility is only one small aspect of a subject that is replete with questions having a bearing on sociological medicine. Although sterility is purely a medical question and one that should be studied by every medical practitioner, the broader sociological aspects must not on that account be allowed to receive less attention at their hands. This was made quite clear in the interim report of the National Health and Medical Research Council on the decline in the birth rate, published *in extenso* in the issue of February 10. The interim report was based to a certain extent on the results of several inquiries that were set in motion by the Council. One of these was undertaken by a medical committee, and its findings have been shortly discussed in these columns. The results of the other inquiries have been published in the report of the eighteenth session of the National Health and Medical Research Council. Two of these "annexures" are of such importance that they should not be allowed to pass unnoticed. One entitled, "The Population Problem in Relation to the Personal Needs of Mothers", is by Dame Enid Lyons, M.H.R., and Lady Phyllis Cilento, M.B., B.S.; the other has been compiled by Dr. J. H. L. Cumpston from statements made in 1,400 letters from Australian women written in response to a public invitation to state their reasons for limiting their families.

Of these two statements it may be said that most well-informed people are familiar with much that they contain and also that medical practitioners need little information on the subject. This may possibly be true, and it would certainly be an advantage if the public could be instructed and made to understand the significance of the whole matter. But medical practitioners are like lots of other people in that familiarity is apt to carry with it a certain complacency, and therefore no apology need be offered for the present discussion. By way of introduction some mention should be made of woman's place in society and of views that are held regarding it. There are women—some people call them emancipated—who would face life on equal terms with men; they want to do the same work, to accept the same responsibilities, to enjoy the same privileges and to receive the same remuneration. While it would be futile to attempt a full discussion of these propositions, it must be pointed out that the complete acceptance of them would deny to woman her essential function and her great privilege—that of motherhood. There are some exceptionally gifted women who can contrive to "have a career", as it is termed, and at the same time to bring up a family of children in a creditable fashion. But generally speaking the bringing up of a family is for the woman a whole-time job, a job, incidentally, in which the father should take a reasonable share. This does not mean that the woman has to be the slave of the family, as unfortunately she often is. The essential point is that woman's life should be planned within the ambit of her chosen or allotted sphere in such a way that it shall be full and many sided, balanced and honourable. Her sphere may be that of a housewife, and here reference may again be made to the contention of Emmy Freundlich, president of the International Guild of Cooperative Women, that the occupation of a housewife is the occupation of a social worker within the family, since the well-being of the individuals who form the family depends on her. "The housewife does not work for herself, nor for her family alone; her working capacity benefits the whole community." The ideas that people have about motherhood and the work of women in the home are of the utmost importance. Dame Enid Lyons and Dr. Phyllis Cilento hold views similar to those already expressed, for in the opening paragraph of their statement they make two observations. The first is that the obvious causes of a diminished birth rate are the material and physical difficulties that arise from the operation of our social and economic system; the second is that the less obvious are the psychological and spiritual factors which so largely influence behaviour. It is inevitable, they think, that the more obvious causes will receive so much attention that the less conspicuous but no less vital causes will be left relatively unregarded. If we follow Dame Enid Lyons and Dr. Cilento in a general outline of their statement, we shall see how closely the obvious and less obvious factors are interwoven. Today, they remark, the mother no longer occupies the place of great honour that has always been assigned to her in the Christian civilization, in which she has been the theme of its greatest literature and its noblest art. A feminine type distinguished by a sophisticated youthfulness has supplanted her. Popular magazines, commercial advertisements, newspaper articles and current fiction all tend to make fashionable a type of feminine beauty not commonly associated with maternity and a mode of living unsuited to the claims of children. The modern woman is led unconsciously to think that motherhood is undesirable. Small families and no families

are fashionable, and we shall all agree that it is extremely difficult to stem the current of fashionable thought. There is a recompense in motherhood—it probably gives more lasting satisfaction than anything else in life—but this is not "vividly apparent" in women of today. Our authors think that among women producing children there is an ever-growing consciousness of the sacrifices entailed. Here we are told: "Perhaps they would be content and happy to make a family the centre of their lives if they could be assured of some recreation and rest; some time to be companionable and to go out with their husbands, and have enough energy left to have fun with their children and to enjoy them." Some women contrive to take a short holiday once a year with their husbands and leave the children in the care of a relative or nurse; again, the reasonable claim is made that one day in each week spent by the mother apart from her children is a stimulus as well as a rest. To do these things, however, calls for money and the provision of household help. When all is said and done, it is true that "it is the attitude of the mind of women themselves towards the whole process of child-bearing that is the final determining factor in the rise and fall of the birth rate". Since obstetricians have a unique opportunity of observing women and their reactions during pregnancy and confinement, the opinions of medical men and women in Queensland and New South Wales was sought. On the replies received to a *questionnaire* the medical observations in the statement have been based. Here we find observations on the first pregnancy and on subsequent pregnancies and on the ideas of women in regard to them. After the birth of one baby the mother is influenced in regard to others by such factors as the nature of the first pregnancy, the age of the child, the experience of the mother in rearing the first child, the financial status of the family, the possibility of obtaining domestic help, the question of housing and the attitude of relatives and friends. Some shrewd observations are made on the family that is in poor circumstances. The mother of such a family may view with great anxiety the coming of another baby, but "in practice, it has been found that those who can least afford to have more children are the least distressed at the prospect of increased responsibility". It is the couple on the "moderate" income, with social ambitions and with their feet on the first rung of the social ladder, anxious to compete with the living standard of their neighbours and to give each child an expensive education, who cannot "afford" one or at the most two children. We read somewhere else in this statement about certain types of mothers not being disturbed if their homes are shabby and their hats old-fashioned. A woman's practice in the matter of hats is in many respects an indication of the character of the woman herself, and there is no doubt that the social pretender with the moderate income will spurn babies in favour of hats. In regard to the attitude of the mother's older female friends and relatives we are told that if women of this generation are to welcome large families as a joy instead of a burden, many aunts and grandmothers of the last generation will, on account of their strong influence with young mothers of today, first have to be converted. Our authors are to be commended on their restrained sentiments and language. Most practising doctors would not be able to follow this so noble example. However this may be, we agree that "in whatever way the mother accepts the news of another pregnancy, even if there should be resentment, the attitude of the doctor towards it can greatly modify her outlook". It is indeed the part of the doctor to foster the mother's interest in the baby and the sense of "pleased expectancy" that follows. He can turn her mind from her own discomforts and disabilities to the well-being of the coming baby. This is a subject to which little, if any, reference is made in text-books on obstetrics, yet it is one that should receive the attention of every obstetrician. Psycho-somatic medicine and surgery are the order of the day; why not psycho-somatic obstetrics?

So far attention has been centred around the psychological aspect of this subject as discussed by Dame Enid Lyons and Dr. Cilento. They refer also to "mechanized maternity", a danger which they see in very large, modern, wonderfully built and equipped women's hospitals. They lay stress on the personal factor in maternal care and on the disadvantages of over-regimentation, the too rigid adherence to a formula in the care of a child, which robs mother and child of an intimacy of relationship that is an integral part of the happiness of motherhood. This theme, which has been pursued by other authors, is one whose practice calls for the exercise of discretion and common sense. There is a discussion on whether childbirth is harmful to women, on special care of the first baby and on ideal ante-natal care. On the subject of "safeguarding motherhood" useful views are expressed; the subjects mentioned include: the standard of homes, aids for families, domestic help and supervised pre-school child care, economic security, maternity services, maternity centres, home-help service, sterility clinics and marriage loans. We do not propose to discuss in detail the recommendations made by the two authors of this statement, but shall be content to indicate the directions in which they tend. Under the heading of social security mention is made of unemployment and sickness benefits and superannuation on the one hand and of the revision of the basic wage and child endowment on the other. Housing and the education of public opinion are also mentioned. A plea is made for an improved standard of maternal care in all its phases; for the compulsory education of girls in mothercraft, domestic arts and home management; and for attention to domestic problems. These problems, it is suggested, should be attacked by: (*a*) the establishment of a home-help scheme as an auxiliary to the maternity service system; (*b*) the organization of a system of domestic training, having as its object the conferring of professional status upon the trainees, and the assistance of mothers and housewives in their normal domestic routine.

The statement by Dr. J. H. L. Cumpston on the replies received from women in response to a publicly extended invitation to state their reasons for limiting their families has been mentioned. When a decision to issue this invitation was announced some persons doubted the wisdom of such a course of action and thought that no good result would follow. Perusal of Dr. Cumpston's statement shows this idea to have been incorrect. The impression left on Dr. Cumpston is that women limit their families for the following four reasons: (*a*) no home, (*b*) no help, (*c*) no security—national or economic, (*d*) no hope for any change for the better in any of these things. We do not propose to describe the replies. Any attempt to do this would mean a reprinting of Dr. Cumpston's whole statement which is itself a summary. What we can and should do

is to point out that the replies sent in by these 1,400 women are indisputable evidence that the recommendations made by Dame Enid Lyons and Dr. Cilento should be carried out. The two documents could with little difficulty be made to dovetail into one another. In conclusion, the opening contention must be repeated—there are in this subject obvious material and physical difficulties and there are less obvious psychological and spiritual factors. To attempt to deal with one group and to neglect the other can end in nothing but failure.

Current Comment.

DIABETES AND TUBERCULOSIS.

THE association of pulmonary tuberculosis with diabetes has always been of importance and interest. Andrew L. Banyai and Anthony V. Cadden, in an article on the subject, summarize some of the more recent literature.[1] They remark on a striking difference between the European and American data, which indicate that though there are wide disparities in the figures of various clinics, the morbidity averages for tuberculosis in diabetics work out at 8·1% in Europe and 2·8% in America. The predisposition of diabetics to tuberculosis can hardly be questioned. Investigation has shown that the so-called reinfection type of pulmonary tuberculosis is many times more frequent among diabetic children and adolescents than among control groups. The reason for this might be vaguely given as nutritional perhaps, but the exact mechanism is not clear. Banyai and Cadden have collected the opinions of a number of writers and comment on them. Hyperglycæmia *per se* they do not accept as a cause of susceptibility to infection, as experimental work does not support the hypothesis, though there is no doubt about the lowered resistance, for the bacteriostatic powers of the diabetic's body fluids are lowered. Other suggestions are that a disturbance of the electrolyte balance is responsible, or that more complicated chemical changes favour the development of the tubercle bacilli, such as those concerned with metabolism of fat or nitrogen compounds. It is claimed that the incidence of tuberculosis is less when the modern high carbohydrate diet is used. But Banyai and Cadden gain the impression that a deficiency of vitamin *A* may be in part responsible. Certainly deficiency of this vitamin causes atrophic changes in the respiratory epithelium with loss of ciliated cells and substitution of a lower grade epithelial tissue. Vitamin *A* is stored almost solely in the liver, and it has been shown that there is a deficiency of stored vitamin *A* in the liver of diabetics. It has also been maintained that this is due to the inability of the liver in diabetes to convert carotene to vitamin *A*. Clinical evidence of lack of vitamin *A* has been reported. Banyai and Cadden quote the work of Freston and Loughlin, who reported that 71% of a group of poorly controlled juvenile diabetics showed low vitamin *A* values, in contrast to 48% of a well-controlled group. It would seem that hypovitaminosis may at least play some part in increasing the susceptibility of diabetics to tuberculosis, but of course it is a complex problem, and it is likely that there may be several causal factors. Banyai and Cadden discuss at some length some of the debatable aspects of diabetic treatment, with particular reference to the control of the sugar level in the blood. Common ground may be found here in the axiom that violent fluctuations of the blood glucose are to be avoided. Hypoglycæmia in particular is to be watched for, particularly with modern retard insulins; but it is encouraging to read that excellent results have been reported in cases of diabetes complicated by pulmonary tuberculosis in which protamine zinc insulin has been used.

One curious fact emerges from these authors' study of the tuberculous diabetics, that the number of such patients treated in special institutions for tuberculosis is much lower than might be expected from the estimated total number. They make this a text for emphasizing the necessity of anticipating the possible existence or onset of tuberculosis in all diabetics, particularly those who are young. With regard to supplying a deficiency of vitamin *A*, Banyai and Cadden consider that administration of carotene alone will not help substantially because of the possible inability of the liver to convert it. The dosage of vitamin *A*, they suggest, is huge—150,000 to 200,000 units daily. The supply of this amount, which they admit "may serve as a useful adjunct" to treatment, would be no easy matter as a routine measure; but all the same, enough evidence has been supplied to make us realize the necessity for not overlooking this dietary factor.

[1] *Archives of Internal Medicine*, December, 1944.

THE ACTION OF DIGOXIN ON THE CIRCULATION.

IT is remarkable how little really reliable knowledge we have about such an indispensable drug as digitalis. Its action in cardiac failure with decompensation is clinically fairly intelligible, and where auricular fibrillation is present digitalis therapy rests on sure foundations. But the more difficult clinical problem of failure with regular rhythm will be thoroughly understood only when details of the pharmacological action of the drug are accurately known. J. McMichael and E. P. Sharpey-Schafer, who have previously contributed to the subject of measurements of cardiac output and auricular pressures, have published a study on the action of digoxin in man.[1] This is based on strictly physiological techniques, including the method of estimating the right auricular pressure by the use of a fine catheter introduced through a vein. Minor variations of cardiac output were disregarded, only a change of 0·4 litre per minute or more being thought significant. Controls of normal subjects were used, and the patients observed included those with *cor pulmonale*, anæmia, hypertension, various types of valvular disease and various degrees of cardiac failure. As lowering of the intraauricular pressure was noted in the course of these experiments, this was controlled by comparing the effects of causing congestion of the legs by pneumatic cuffs. The digoxin was introduced intravenously through the catheter. The one constant effect was a fall in the pressure in the right auricle. The cardiac output was reduced in some cases. These included cases of anæmia and *cor pulmonale* in which there is oxygen want and the output of the heart is naturally high. The interesting group was, however, that showing increased cardiac output following the administration of digoxin: those with ordinary sinus rhythm and those with auricular fibrillation were studied separately. It was rather surprising to find that a simple mechanical method such as the use of cuffs on the legs which caused fall in the auricular pressure increased the output of the heart to the same degree as the digoxin.

The authors put forward the hypothesis that the failing heart behaves like the overloaded heart-lung preparation used by Starling in his classical experiments. In each case as the venous pressure increases a stage is reached when the cardiac output starts to fall. Their other conclusions are that digoxin when given intravenously lowers the pressure within the right auricle, and in most cases of congestive cardiac failure increases the output of the heart. Since mechanical lowering of the right auricular pressure brings about a similar degree of increase of cardiac output, they suggest that the beneficial action of digoxin is not from any stimulating effect on the myocardium, but from a peripheral effect on the venous pressure. Their observations on the debated question of the influence of rate control in auricular fibrillation on cardiac output point to the fall of venous pressure as the most important element in the mechanism.

There is little doubt that digitalis and its active principles are often misused, and it is to be hoped that further accurate work on sound physiological lines will make clearer its particular virtues and indications.

[1] *The Quarterly Journal of Medicine*, October, 1944.

Abstracts from Medical Literature.

BACTERIOLOGY AND IMMUNOLOGY.

Bacteriostatic Substances in Fungi.

W. H. WILKINS AND G. C. M. HARRIS (*The British Journal of Experimental Pathology*, October, 1944) have studied a further 100 species of *Penicillium* in their investigation into the production of bacteriostatic substances by fungi. They made crude extracts and tested them for inhibitory power against the growth of *Bacterium coli*, *Pseudomonas pyocyanea* and *Staphylococcus aureus*. Three varieties were found to have an action against *Pseudomonas pyocyanea*, 19 against *Bacterium coli*, and 39 against *Staphylococcus aureus*. Some strains of fungi classed as "larger basidiomycetes" were also studied, and some strongly positive extracts were obtained. Those giving promising results are being investigated chemically and therapeutically at the Oxford School of Pathology.

Removal of Bacteria from Blood.

ELVIN A. KABST, PHILLIP C. MILLER, HILDA KAISER AND ALICE Z. FOSTER (*The Journal of Experimental Medicine*, January, 1945) have made observations on the sites of removal of bacteria from the blood of patients with bacterial endocarditis. Paired samples of blood from artery and vein were obtained, by way of flexible endovascular catheters through which 1·5 to 2·0 mils of blood were collected. Pour plates were made with 1·0 millilitre of blood with 20 millilitres of agar base and incubated at 37° C. for seventy-two hours. Six different patients whose blood constantly yielded a growth of *Streptococcus viridans* were selected for study. Colony counts were highest in arterial blood, ranging from 10 in one patient to 600 per ml in another. The count in the *vena cava* was usually half to two-thirds that in the arteries, while the count on blood from hepatic veins was constantly low. Blood from the antecubital veins varied only slightly from arterial blood in its bacterial content, and there was a remarkable constancy of counts from hour to hour. The authors consider that their evidence shows that there is a steady discharge of organisms into the blood from endocardial vegetations, and that a considerable number are removed from the blood in a "single circuit" of the body.

Immunization against Influenza.

G. K. HIRST, E. R. RICKARD AND W. F. FRIEDWALD (*The Journal of Experimental Medicine*, October, 1944) have studied the duration of immunity induced by inactive influenza virus. They used the H strains only, prepared from allantoic fluid, and the vaccine was inactivated by formalin, stored for two to three months, and then administered subcutaneously to groups of volunteers in seven different institutions. Serum antibody levels were studied in order to assess final results, and it was found that about 64% of persons vaccinated had levels of 30% above prevaccination figures, tested eleven to fourteen months later. Nation-wide epidemics of influenza began affecting the vaccinated groups, during which virus was isolated from some patients, and patients recently admitted to the institutions showed sharp rises in antibody titre after an illness resembling influenza. The analysis of numbers of infected persons amongst test and control groups showed that there was a reduction in attack rate of 35%, and numbers of the protected people still had antibody levels considerably above their prevaccination figures.

Infection of Mice with Mycobacterium Tuberculosis.

R. E. GLOVER (*The British Journal of Experimental Pathology*, October, 1944) has produced infection of mice with *Mycobacterium tuberculosis bovis* by the respiratory route. He devised an apparatus in which an aerosol was produced in a chamber where the larger particles were allowed to settle and then passed over to a chamber where mice in cages could be placed. The chambers were disinfected with formaldehyde vapour and ammonia vapour after withdrawal of the cages. Bovine strains fully virulent for rabbits were employed. It was found that doses of 100 organisms would infect some mice, while doses of 1,000 organisms would infect all groups of mice. The lesions found at autopsy in mice are fully described.

National Collection of Type Cultures.

R. ST. JOHN BROOKS (*British Medical Bulletin*, Volume II, 1944, Number 12) has described the foundation of the National Collection of Type Cultures. He enumerates the donors of cultures, the personnel and work done under the ægis of the Medical Research Council. He mentions the preparation of a new catalogue of the collection and the interest taken by the staff in the problems of bacteriological classification. The future development of the collection is discussed, and a scheme of decentralization is outlined, whereby sections of the collection will be housed in special laboratories appropriate for their best use and care, while a limited selection of test cultures will be maintained at the headquarters for teaching purposes. The curator believes that special care should be exercised to provide material for work in fundamental biological studies, and new facilities developed for areas not now adequately served. International cooperation in this respect should be diligently fostered.

Meningococcal Infections in Childhood.

JOSEPH OSBORNE, WILLIAM H. ARNONE AND GEORGE I. LYTHCOTT (*The New England Journal of Medicine*, December 28, 1944) have made a statistical analysis of 72 cases of meningococcal meningitis and meningococcæmia in childhood. The incidence coincided with that of upper respiratory infections in summer and late autumn, and 56% of patients were under the age of five years. Fifty-nine patients exhibited a rash when first seen and 56 had temperatures of over 102° F. Nine patients exhibited the dyspnœa and cyanosis and peripheral circulatory failure associated with Waterhouse-Friderichsen syndrome; four of these recovered, and of the three on whom autopsies were performed, all showed adrenal hæmorrhage. Meningococci were isolated and typed in 59 cases, and 55 strains proved to be type 1; four were type 2A. Treatment was with sodium sulphadiazine, given immediately by intravenous drip in a dosage of half to three-quarters of a grain per pound of body weight. If this was difficult, the drug was given in saline solution subcutaneously in a concentration of not more than 5% of the drug. If adrenal hæmorrhage was suspected, five cubic centimetres of adrenocortical extract were added to the solution injected intravenously. Chemotherapy by mouth was begun six hours after the intravenous dose, and continued up to ten days. Satisfactory clinical improvement occurred when the concentration of sulphadiazine was ten to twelve milligrammes per 100 cubic centimetres. Nine patients showed a complicating arthritis during convalescence. The mortality rate was 8% and only one child without adrenal involvement died. Four children who had shown symptoms of adrenal involvement survived.

Cold Agglutinins and Primary Atypical Pneumonia.

CRICHTON MCNEIL (*The American Journal of the Medical Sciences*, January, 1945) has studied the relationship of cold agglutinins to the course of primary atypical pneumonia. A small epidemic provided material for a careful laboratory study; rigid clinical criteria for diagnosis were met, and a sputum examination failed to reveal any accepted pathogenic bacteria. Tests were performed with serial dilutions of fresh non-inactivated serum, to which was added 2% suspension of washed Group O human red cells. Readings were made under magnification after incubation overnight in the ice box. The peak of the serum titre was found to occur on the day before the patient's temperature fell by crisis, and the agglutinins disappeared when fever had abated. The usual end point in the test was at a serum dilution of about 1 in 200, but high figures were seen. The agglutinins affected the patient's own cells as well as those of Group O. Serum from patients with lobar pneumonia or bronchopneumonia were subjected to the same technique without significant results being obtained.

Modern Methods in the Control of Typhoid and Paratyphoid B Fevers.

A. FELIX (*British Medical Bulletin*, Volume II, 1944, Number 12) reviews laboratory methods in the control of typhoid and paratyphoid B fevers. Two tests in particular have been found of great importance, namely, the typing of bacilli by anti-Vi bacteriophage and Vi agglutination tests. The Vi antigen was the first factor to be discovered which demonstrated different strains of typhoid bacilli; previously they had been thought similar. The anti-Vi bacteriophage differentiated strains which were otherwise identical. The value of this test immediately became obvious when correlation between cases and carriers was attempted, and successful field epidemiological studies were made. Felix had previously established the presence of a heat-labile somatic antigen in *Bacterium paratyphosum* B, again more specific than the O antigen, and established the existence of five Vi types, also permitting here successful epidemiological

studies. Vi agglutination tests are now used as a screen in the search for typhoid carriers, since excretion of bacilli is very intermittent. An instance is quoted in which serum from a suspected carrier gave four positive results to agglutination tests with the Vi antigen, while many samples of fæces were examined without the isolation of *Bacterium typhosum*, but in view of the serological tests the search was continued, and finally *Bacterium typhosum* was found. The test could be used to follow patients during convalescence, and those with rising Vi titre should be watched for the development of the carrier state. The position in relation to Vi agglutination in paratyphoid B infections is not so clear, but may alter when more information has been gathered.

Atypical Pneumonia.

THE Commission on Acute Respiratory Diseases (*The American Journal of the Medical Sciences*, January, 1945) has studied atypical pneumonia. The clinical features being unremarkable, reliance for early diagnosis was placed on an X-ray shadow of infiltration in the lung, later a productive cough, moderate prostration for three to eight days, followed by long convalescence and complete recovery. Transmission experiments have been successful and "cold" agglutinins develop in the patient's serum. Epidemics have been reported in some areas, but commonly the cases occur sporadically. Contact droplet and air-borne infection seem to be the common methods of spread.

HYGIENE.

The Maternity Hospitalization Act of Alberta, 1944.

M. R. BOW (*Canadian Journal of Public Health*, December, 1944) states that a resident of Alberta for twelve consecutive months in the preceding twenty-four months (or so entitled under war regulation) is entitled to free hospitalization and maternity service (1944) for herself and her newborn offspring for not more than twelve days including the day of delivery (after at least twenty-eight weeks' gestation). Semiprivate and private wards are permitted, but no liability is accepted for extra costs. The daily payments by the health departments to the hospitals range from 2.10 to 3.60 dollars per patient *plus* 45 cents per day for the mother and 45 cents per day for the child. In 1942 84·7% of births occurred in approved hospitals (about 16,340 out of 19,290 registered). At least 90% are expected in 1944. A complete survey of hospital staffing and equipment was made by two maternity specialists and two hospital administrators and marks were awarded on a point system; the details of these are of interest as indicating the standard followed in Canada. Only five points are given for an emergency blood service, as compared with ten for physiotherapy and four points for a clock (in labour room) with "swoop hand".

A Mouse Protection Test for Cholera Vaccine.

L. E. RANTA AND C. E. DOLMAN (*Canadian Journal of Public Health*, December, 1944) have standardized vaccines for human use at 8,000 million vibrios per cubic centimetre (diluted for mice 1 to 5). Inbred mice of 10 to 25 grammes weight were selected at random. The virulent Ogawa strain of *Vibrio choleræ* used killed with one minimum lethal dose of 500,000 vibrios suspended in 0·5 cubic centimetre of 5% mucin, 80% to 100% of normal mice. Death took place in twenty-four hours as a rule. Mice given two doses of vaccine one week apart, when tested fourteen days later, stood up to three minimum lethal doses which killed over half of those given one dose; three spaced doses made no significant difference. The phenolized pooled vaccines kept their protective power in full for twelve months with slow falling off the next year. The standard of antigenic potency should protect 100% of mice against five minimum lethal doses and 80% at least against ten minimum lethal doses. Of twenty offspring of female mice vaccinated and surviving three minimum lethal doses before mating, twelve survived when challenged at eight weeks old. Specific humoral antibodies are thus handed on by parent to offspring. Both Inaba and Ogawa type strains were used in pooled vaccine as cross-protection was demonstrated. The aim has been to eliminate any vaccine which fails to protect mice. The efficacy of the mouse protection test for antigenicity of cholera vaccine awaits the final test in the field.

Chlorination of Human, Monkey-Adapted and Mouse Strains of Poliomyelitis Virus.

J. D. TRASK, J. L. MELNICK AND H. A. WENNER (*American Journal of Hygiene*, January, 1945) have made a study of the effect of various compounds of chlorine—sodium hypochlorite, chloramine *et cetera*—on various strains of poliomyelitis virus. A residual chlorine level of 0·4 to 0·5 part per million for ten minutes was insufficient to inactivate strains in cord emulsions, and 10% stool suspension withstood a chlorine dose of 120 parts per million which left a residual value of fifteen parts per million after ten minutes' contact. Chloramine similarly needed a residual chlorine level of 0·57 part per million after thirty minutes of contact to reduce the infectivity of brain infected with a 10^{-5} concentration. Increase of virus concentration ten times or more required a proportionate increase of chlorine. Sodium hypochlorite required a residual chlorine level of 0·35 part per million. For a tenfold increase in virus a fivefold increase of disinfectant was needed. The increase of eighteen times or so of chlorine residual values needed in the presence of organic matter emphasizes the caution needed under natural conditions.

Epidemic Diarrhœa, Nausea and Vomiting of Unknown Cause.

H. A. REIMANN, J. H. HODGES AND A. H. PRICE (*The Journal of the American Medical Association*, January 6, 1945) discuss a mild epidemic disease characterized by anorexia, malaise, diarrhœa, nausea and vomiting which occurred in October and November of 1943 and 1944 in Philadelphia and its environs. They point out that a gastro-intestinal disturbance similar to the one described by them has occurred in Germany, Canada, England, Denmark and Australia. Because of its mildness this disorder usually passes unnoticed in the press of other problems. Epidemics occur at all seasons of the year, but especially in the autumn, and in different groups from 15% to 100% of persons are involved. The incubation period is estimated as between thirty hours and seven days, usually two days. During an epidemic in 1943 20% of a group of students were affected, and in 1944 the number was 10%. The epidemics were apparently not related to food or water and were not caused by any known bacilli of the enteric group. The authors point out that a filtrable virus has been suggested as the cause; they add that it is still unknown whether the infection is primarily one of the respiratory tract, of the central nervous system, as some observers believe, or of the gastro-intestinal tract, which seems more likely. The authors were unable to transmit the disease to animals or to isolate a filtrable agent, but "suggestive results" were obtained with volunteers. The condition is often ignored, unrecognized or mistaken for influenza, food poisoning, bacillary dysentery, acute appendicitis or mesenteric adenitis.

Noise and the Worker.

H. DAVIS (*The Journal of Industrial Hygiene and Toxicology*, February, 1945) discusses the question of noise in industry. He considers that undue apprehension as to damage to the hearing of workers from noise may be engendered by well-meant medical warnings and by the statements of manufacturers of ear plugs. Subjects vary in their ability to tolerate noise without damage, either temporary or permanent, and it has been known for some time that a hearing loss similar to that caused by noise occurs normally with advancing age. No proof exists that permanent impairment of hearing occurs as a result of noises of intensity less than 115 or 120 decibels (sufficient to drown the loudest shout), and concern about exposure to noise levels below 100 decibels (such as a subway express passing through a local station) is probably unwarranted. However, somewhere along the scale of exposure, noise becomes an industrial hazard. There are three obvious principles of protection against injury: (i) to reduce the production of noise; (ii) to absorb the noise after it has been generated; (iii) to exclude noise from the ear. The first two principles, if applied, will successfully deal with a certain amount of noise (the substitution of welding for riveting, the "sound-proofing" of such places as offices and cafeterias *et cetera*). But unfortunately neither of these will eliminate all the high-level noises from industry. The improvisation of ear plugs from absorbent cotton or from cotton waste is an old trick, and can effect a five or ten decibel reduction in noise. The author discusses in detail the advantages and disadvantages of the various methods of attempting to exclude noise from the ear, and recommends several of the newest ear wardens. He points out that difficulty may be experienced in inducing workers to make use of them, and some education as to their value may be necessary. In one factory in which the use of one of the new types of ear warden was introduced, an unexpected incidental result was a sharp reduction in absenteeism.

British Medical Association News.

SCIENTIFIC.

A REPORT ON THE IMPROVEMENT OF MATERNITY SERVICES.

THE following report on the improvement of maternity services by the Section of Obstetrics and Gynæcology of the New South Wales Branch of the British Medical Association is published at the request of the Branch Council.

The Section of Obstetrics and Gynæcology of the New South Wales Branch of the British Medical Association at a meeting held in the Council Room, British Medical Association House, on Wednesday, March 14, 1945, discussed how "hospital, medical and nursing services for maternity cases could best be improved".

Professor Mayes opened the discussion by giving the meeting a general outline of the recommendations of the Special Medical Committee appointed to investigate child wastage, which have been forwarded to the National Health and Medical Research Council. These recommendations were endorsed by the Section.

The following recommendations were made by this Section for forwarding to the Federal Council of the British Medical Association, so that they may be put before the National Health and Medical Research Council through the British Medical Association's representative on that Council.

General Requirements.

Certain requirements, whilst not directly concerning this branch of medicine, are highly desirable as a foundation improvement in maternal and infantile welfare.

(*a*) Improved national nutrition.

(*b*) Good housing.

(*c*) Ample and efficient domestic service, particularly during late pregnancy and lactation.

(*d*) Legislation should be introduced to prevent women working in industry after they have become pregnant, by providing for their support during this period.

(*e*) The encouragement of earlier marriages by stabilizing national finance and assuring a just reward to industry and thrift so that the young man is able to plan a future with some security.

(*f*) The abolition of unnecessary contraception and criminal abortion.

(*g*) Public tolerance of the unmarried mother.

(*h*) The importation of young males and females.

Factors Directly Concerning the Section.

The following factors more directly concern this section of medicine:

1. Proper and efficient care should be provided for those who have miscarried, either spontaneously or by criminal abortion. Failure to treat these cases efficiently results in sterility, whereas if treated properly in good surroundings, fertility may be preserved. At least 250 beds in the Sydney metropolitan area should be reserved for this class of case.

2. The present ante-natal clinic service for indigent women should be extended, but such extension should be in close association with obstetric hospitals.

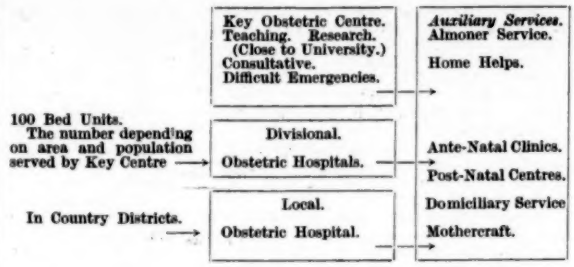
3. Under modern conditions in big cities confinements in homes are undesirable. This follows the trend of public opinion over the last nine years (Appendix, Table II). A similar trend is occurring in England.

The Development of Obstetric Practice.

1. Obstetric services to the public should be planned on the principle shown on the diagram below and future hospital building and distribution of new obstetric beds should conform to this plan.

The area and population served by each type of hospital would vary according to geography, transport *et cetera*. The principle is applicable to country as well as metropolitan areas.

2. Obstetric beds. Seven hundred to eight hundred additional beds are required in maternity hospitals in Sydney metropolitan area (excluding private hospitals).



Obstetric bed needs should be estimated thus:

(*a*) Lying-in beds: 20 patients per bed per annum.

(*b*) Ante-natal beds: Add at least an additional 33%. These are required for simple rest and nutrition as well as for the treatment of complications.

(*c*) Post-natal beds: Add 10%. These beds are in addition to ordinary lying-in beds, for women who are not well enough to return to their homes and undertake normal responsibilities, but who are not sick enough to remain in an acute bed. (See Appendix for details of bed estimation. Actual figures given only apply to Sydney metropolis, but method of estimating needs applies to any geographical zone.)

3. Nursery beds. No existing maternity hospital or unit has provided adequately, in its original design, for nursing of infants. In addition to nurseries for normal healthy babies it is essential to provide:

(*a*) Premature babies ward.

(*b*) Ward for sick babies.

(*c*) Isolation wards (for individual isolation) for babies with infectious conditions.

4. In addition to an ample honorary consulting staff, every major obstetric hospital should have in residence a "clinical master in obstetrics", who should be a mature and experienced obstetrician with proper remuneration, assisted by senior resident medical officers in the proportion of one to every 100 beds and junior resident medical officers one to every 50 beds.

5. Only generally trained nurses should be accepted for training in obstetrics and their salary should be that of a fourth year nurse. To avoid overtiredness due to the irregularity and stress of obstetric work, the nursing staff should be ample, especially in the labour rooms and nurseries. It should be recognized that a baby requires more attention than a mother and costs as much to keep.

6. Nurses should be relieved of the domestic work in centres and hospitals so that they may concentrate on nursing. For example, the serving of meals, cleaning of day rooms *et cetera* should not be done by nurses.

7. A cadet nurse, or assistant nurse service should be established to assist the nurse and to carry out the domestic attention necessary for the woman during her confinement and afterwards. The status of personnel in this service would be comparable to the Australian Medical Women's Army Service, with a salary intermediate between that of a trained nurse and a domestic.

8. Obstetric trainees should be able to do mothercraft training during the course in an obstetric hospital.

9. The cadet nurse girl service or assistant nurse should be, where necessary, available to the mothers in the home after confinement and discharge from hospital for a period of eight weeks.

10. To raise the standard of obstetrics in medical personnel, increased post-graduate teaching is required as well as encouragement to doctors to take post-graduate degrees in obstetrics and gynæcology.

Appendix.

TABLE I.

Year.	Births Occurring in Metropolitan Area.	Births Occurring in Rest of State.	Total.
1934	18,909	26,435	45,344
1943	29,112	28,183	57,395
1944	32,000[1]	29,030[1]	61,030

[1] Estimated number.

Comment.—(*a*) In 1944, 61,000 babies were born and from general trends indicated in table, 32,000 would have been born in the metropolitan area in 1944. (*b*) In the past ten years, metropolitan births have increased by 10,000 and country by less than 2,000. At present slightly more than half the State's total births are in the metropolitan area.

TABLE II.

Distribution of Births in Metropolitan Area.

Year.	Obstetric Units at General Hospitals.	Public Maternity Hospitals.[1]	Private Hospitals.	Homes.	Percentage of Births in Private Homes to Total.	Percentage of Births in Private Hospitals to Total.
1934	774	5,832	6,383	5,121	28·2	34·9
1943	3,702	12,198	12,100	1,109	3·8	41·2

[1] Public maternity hospitals include their private and intermediate wards.

Comment.—In 1943, 55% of births occurred in public hospitals (as defined). With forced closing of private hospitals and trends of public opinion this percentage will steadily increase.

TABLE III.

Returns from the Nine General and Maternity Hospitals in the Metropolitan Area in 1942.

Hospital.	Type.[1]	Beds.	In-Patients, 1942.	Number of Patients per Bed.
Royal North Shore	G.	44	845	21·5
Mater Misericordiæ	G.	50	1,242	24·8
Saint Margaret's	M.	60	1,565	28·1
Ryde District	G.	32	611	19·1
South Sydney	M.	30	273	9·1
Royal, Paddington	M.	213	3,338	15·6
Crown Street Women's	M.	241	3,881	16·1
Royal Prince Alfred (King George V)	M.	108	2,314	21·4
Saint George District	G.	26	550	21·2
Total		804	14,719	18·3

[1] "G" = General hospital with obstetric unit; "M" = Maternity hospital.
Note.—Since this table was compiled (1942) the total number of obstetric beds available has increased to approximately 870. (Increase mainly at King George V Hospital and Mater Misericordiæ.)

Comment.—(i) The average stay in hospital of 18 days per patient allows each bed to accommodate 20 patients *per annum*. This agrees with opinion in Great Britain. (ii) In estimating beds available, at least 100 beds should be deducted from the existing total of 870 to allow for proper bed spacing in present overcrowded wards. During the past few years every hospital in Sydney has worked at over 100% occupancy. Wards that were built to have 16 beds have had 32 crowded into them.

Conclusion.

At least 60% of 32,000 births will be in maternity hospitals (excluding private hospitals), that is, approximately 20,000.

Twenty thousand births require:

1,000 lying-in beds
333 ante-natal beds
100 post-natal beds

1,433 beds.

Under proper working conditions 770 are available. The deficiency is 663 beds.

The closing down of private hospitals still continues, and will continue. Consequently plans for obstetric accommodation must be ahead of requirements. Allow 100 beds for this. On the facts available 750 to 800 additional obstetric beds are urgently required.

On behalf of the Section of Obstetrics and Gynæcology, New South Wales Branch.

(Signed) J. N. CHESTERMAN.

NOTICE.

THE General Secretary of the Federal Council of the British Medical Association in Australia has announced that the following medical practitioner has been released from full-time duty with His Majesty's Forces and has resumed civil practice as from the date mentioned:

Dr. S. W. Dobell-Brown, 112, George Street, Liverpool, New South Wales (May 1, 1945).

Medical Societies.

MELBOURNE PÆDIATRIC SOCIETY.

A MEETING of the Melbourne Pædiatric Society was held on October 11, 1944, at the Children's Hospital, Carlton, Melbourne, DR. ALAN MCCUTCHEON, the President, in the chair.

Tumour of the Liver.

DR. W. R. FORSTER showed a female child, aged nine weeks, who had developed swelling of the upper part of the abdomen four weeks previously. This was noticed on a routine visit to the doctor. On examination at that time a large, firm tumour was found in the upper part of the abdomen, continuous with the liver, mainly on the right side, and extending down to the umbilicus. It had an indefinite edge. No other abnormality was detected. An X-ray examination revealed a large tumour of uniform opacity and smooth outline occupying the whole of the upper part of the abdomen; it appeared to arise from the posterior abdominal wall, to extend into the pelvis and to push most of the coils of bowel downwards and to the left. Laparotomy was performed on September 20, 1944. Through an upper transverse incision a large tumour of the liver four inches in diameter was disclosed. This tumour involved the whole of the lower part of the anterior surface and part of the posterior surface of the liver. A small wedge was excised. It was impossible to remove the tumour *in toto*. Dr. Reginald Webster examined the biopsy specimen, and reported the presence of fibrous tissue, much of which was of mucoid character; a few bile canaliculi appeared, but no hepatic tissue was seen. Dr. Webster gained the impression that the tissue was derived from the wall of a cyst, such as a congenital cyst arising in connexion with the biliary system.

DR. REGINALD WEBSTER said that he had been sent the biopsy specimen for study. He was quite confident that it was not from a tumour of the liver. It was composed of fibrous tissue, much of which was myxomatous. He felt sure that it was of the nature of a non-parasitic cyst of the liver, somewhat analogous to congenital cystic disease of the lung. The bile ducts developed as a mesothelial bud, and if they were not canalized they became cystic. In the liver some of these cysts had an adenomatous arrangement of cells in their walls.

Morquio's Disease.

DR. L. WAIT showed a male child, aged fourteen years, suffering from osteochondrodystrophy first described by Morquio. The boy had been referred to him by Dr. W. R. Forster on August 7, 1944, because of muscular weakness. He did not walk until the age of three years. It was soon observed that he had pronounced muscular atonia, and this became progressively worse as he grew older, especially in recent months. He was unable to engage in physical activities on account of the weakness, and was fatigued after exercise. He had never been able to run. His mentality appeared to be good, and his mother stated that he had been bright in his school work.

On examination, the patient was seen to be a bright, intelligent lad showing obvious physical deformities. Wasting of the thigh muscles and shoulder girdle muscles was noticed, particularly in the right shoulder. On rising from the supine position he tended to "climb up his legs" like a patient with pseudohypertrophic muscular dystrophy. The reflexes were present. No sensory loss was detected. Muscular reactions were tested by the massage department; a fairly strong faradic current was used, and all responses were slow. Both arms responded fairly evenly, the flexors acting more strongly than the extensors. The right leg responded more strongly than the left leg. More detailed examination revealed that the responses of the individual muscles varied from "good" to "very poor". Some muscles

showed a doubtful contraction. As Dr. E. G. Robertson had been attending the patient's father for Morquio's disease and Parkinson's syndrome, and as he had also seen this boy, the patient was referred back to him for an opinion. Dr. Robertson said that the son was an amazingly perfect replica of the father. He agreed as to the presence of the muscular wasting. He stated that the reason for the wasting was difficult to determine and was probably part of the syndrome. Dr. Robertson also interviewed the paternal grandfather of the boy; he said that though the grandfather was of small stature, he would pass as a normal man. He was not radiologically examined, owing apparently to some family hostility. A brother of the boy under discussion was apparently normal. Dr. Wait thanked Dr. Robertson for the information given.

DR. W. R. FORSTER said that the child was unusual, in that both femora and humeri were abnormally short and so resembled those found in achondroplasia. The condition was also peculiar in that lordosis was extreme, and the boy's gait was similar to that seen in congenital double dislocation of the hips. Recently considerable muscular weakness had been detected, and so the possibility of pseudo-hypertrophic muscular dystrophy arose. From these confusing findings it was not surprising that the child presented a problem in diagnosis, and indeed had attended the hospital for twelve years without the true condition being realized. Dr. Forster produced a letter from Dr. Hewlett drawing attention to the fact that many years earlier he had been interested in a case of this nature. Dr. Hewlett was unable to be present at the meeting, but he had sent X-ray photographs of his patient for comparison.

DR. COLIN MACDONALD agreed with Dr. Wait that the patient's condition be regarded as belonging to the Morquio type of osteochondrodystrophy. Dr. Macdonald said that Morquio had practised pædiatrics some miles from where the *Graf Spee* was sunk, at Montevideo in Uraguay. It was fifteen years earlier, in 1929, that Morquio had described two cases of familial and generalized osseous dystrophy, akin to achondroplasia in the shortness of the patient's stature, but differing in essential features from this well-recognized disorder. Morquio's description quickly attracted the attention of radiologists because of characteristic X-ray features, and in 1933 Dr. D. O. Brown and Dr. Macdonald had discovered a family in Melbourne and presented them at a meeting of the society.

Dr. Macdonald went on to say that there would appear to be a few critics of the use of eponymous nomenclature in this condition; but it was incumbent on those who, like himself, deliberately and fondly employed such nomenclature to be fully informed on what the original author was describing. The main criticism of the medical eponym had sprung from its too wide and too loose application. Dr. Macdonald regretted that the practice introduced when he occupied the presidential chair of the society, that resident medical officers prefaced the presentation of each case with a succinct historical introduction, had fallen into abeyance, because he was sure that such an exercise, benevolently administered, inflicted no hardship either on the resident medical officers or on the audience. Dr. Macdonald then presented a précis of what Morquio had written in his original description in *Archives de médecine des enfants* of March, 1929.

The children were born normal, and developed normally during the first year. When they started to walk, changes were noted; these were accentuated in the following months, and became stationary and definite. These manifestations were bony changes, without pain, which affected the vertebral column and the extremities, but spared the head and the face. Functional troubles resulted, especially those of motility, and physical troubles modified completely the harmony of the body. The deformities of the skeleton were generalized and symmetrical. In certain regions there were bony protuberances, as in the sternum, the vertebral column, the epiphyses of the shoulder, the elbows, the knees, *et cetera*. In other regions retardation or absence of ossification was noted. The ligaments, and particularly the muscles, were soft and relaxed; this condition gave a peculiar flaccidity to the joints, limited, however, in certain regions, as in the shoulders and the elbows, by bony deformities. In other regions, however, as in the hands and feet, this flaccidity reached extreme degrees. As a consequence, the whole body presented considerable deformity, characterized by longitudinal shortening and antero-posterior deepening of the thorax, with the sternum projecting to a point; this formed a contrast with the extremities, which, though deformed, had normal dimensions, and gave to the children the appearance of sufferers from Pott's disease with an extensive gibbus. The *genu valgum*, the flat feet, the malformation of the vertebral column and the weakness of the muscles and tendons gave rise to a difficult gait resembling that of a duck. The strength in the hands and the feet was greatly diminished, without apparent muscular atrophy or any change in the electrical reactions. The mentality was normal, and the children had intelligent facial expressions. Essentially the condition was a familial dwarfism, with a generalized osteochondrodystrophy, which radiographically produced marked and characteristic changes in the hips and spine.

Dr. Macdonald said that the condition had to be differentiated from another type of dwarfism, achondroplasia; but Morquio's disease was essentially familial (which achondroplasia was not), and radiologically the conditions were very different. Achondroplasia was primarily an aplasia of cartilage only—mainly the cartilage of the epiphyseal lines—expressed radiographically by narrowness and early disappearance of this epiphyseal line and by short, clumsy long bones; but in Morquio's disease, not only the cartilage, but also the ossific nuclei of the epiphyses were profoundly disturbed in their structure and growth. In this particular, Morquio's disease was more allied to the localized osteochondropathies such as Perthes's disease. Both achondroplasia and Morquio's dwarfism produced vertebral changes; but in achondroplasia the pelvis was of the flattened, platypelloid type, while in Morquio's disease it was usually heart-shaped.

Dr. Macdonald went on to say that the subject of osteochondrodystrophy was complex, and forms intermediate between achondroplasia and Morquio's disease did occur; but the essential of Morquio's dwarfism was its familial character, and its marked generalized osteochondral changes as shown radiographically particularly in the hips and spine, the short stature being due in the main to the hip and spine changes. Other types of generalized osteochondropathy, such as multiple exostoses and multiple enchondromata, were encountered, which showed hereditary and familial tendencies; but in these there was no dwarfism. Other osseous dystrophies—dystrophies mainly of membranous bone—had hereditary and familial characteristics; they were cleidocranial dysostosis and the craniostenoses, such as scaphocephaly and craniofacial dysostosis (Crouzon's syndrome), but in these there was no dwarfism, and no epiphyseal or spinal changes occurred. It would be reasonable to assume, with such widespread bony changes, that the calcium level of the blood would be profoundly altered; but in this, as in many other generalized bony diseases, the blood calcium level, so far as Dr. Macdonald knew, varied surprisingly little, if at all, from the limits of normality.

DR. ROBERT SOUTHBY said that still another condition apart from those mentioned by Dr. Macdonald had to be considered in the differential diagnosis of this disease. This was gargoylism, a disease characterized by dwarfism, osteochondrodystrophy and vertebral changes. But here only one vertebra was affected, the change consisting of a peculiar hooking of the anterior part of the body of the vertebra. Mental deficiency accompanied gargoylism, but not Morquio's disease.

(To be continued.)

National Emergency Measures.

AN AMENDMENT OF CONTROL OF MEDICAL EQUIPMENT ORDER.

THE following amendment of control of medical equipment order has been promulgated in the *Commonwealth of Australia Gazette*, Number 84, of April 26, 1945.

In pursuance of regulation 42 of the National Security (Medical Co-ordination and Equipment) Regulations, and of the powers delegated to me by the Chairman of the Central Medical Co-ordination Committee under regulation 20 of those Regulations, by Instrument of Delegation dated the fourth day of October, 1943, I, Hibbert Alan Stephen Newton, Chairman of the Medical Equipment Control Committee, acting upon the recommendation of that Committee, hereby make the following Order:

Prescriptions.

1. Paragraph 5 of the Control of Medical Equipment Order is amended by omitting from sub-paragraph (3.) the words "more than twice" and inserting in their stead the words "more than once in the case of prescriptions containing any

of the drugs specified in Part II of the First Schedule or more than twice in the case of prescriptions containing any other specified drugs".

2. The First Schedule to the Control of Medical Equipment Order is repealed and the following Schedule inserted in its stead:

"THE FIRST SCHEDULE.

List of Drugs to be sold only on the Prescription of a Registered Medical Practitioner or Veterinary Surgeon.

PART I.

Chiniofonum compounds such as Quinoxyl, Yatren, Loretin;
Emetine and Salts;
Ergot and all preparations and Alkaloids thereof;
Filix Mas and Extracts;
Hyoscine and Salts;
Liver Extracts for parenteral administration, such as Anahæmin, Campolon, Examen, H.C.L., Hepastab, Hepatex-T, Liver Ext. B.D.H., Liver Extract Intramuscular (Parke, Davis and Co.), Neo-hepatex, Pernæmon, Reticulogen;
Local Anæsthetics such as Butyn, Decicain, Diocaine, Metycaine, Percaine, Tutocaine;
Metrazol compounds such as Cardiazol, Phrenazol, Leptazol;
Nikethamide compounds such as Coramine, Calcio-Coramine, Icoral, Solucamphre, Anacardone;
Oleum Iodisatum preparations such as Iodatol, Iodinol, Iodipin, Lipiodol, Neo-hydriol, and other analogous iodine compounds such as Abrodil, Perabrodil, Tenebryl, Iodoxyl, Pyelectan, Uropac;
Organic Arsenic compounds such as Acetarsol, Acetylarsan, Devegan, Kharophen, Orarsan, Spirocid, Stovarsol, Neoarsphenamine, Neo-Karsivan, Neo-Salvarsan, N.A.B. Novarsan, Novostab, Mapharsen, Tryparsamide, Treparsol, Carbarsone;
Paraldehyde;
Physostigmine and Salts;
Procaine Hydrochloride and all proprietary brands of *p*-aminobenzoyl-diethylaminoethanol; also all related drugs used by percutaneous injection for local or spinal anæsthesia;
Quinidine and Salts;
Sulphonal;
Synthetic Antimalarials such as Quinacrine, Præquine, Plasmoquine, Atebrin.

PART II.

Sulphonamides and preparations allied to or derived from Sulphonamides whether described as Soluseptasine, Sulphanilamide, Sulphapyridine, Sulphadiazine, Sulphamethazine, Sulphamerazine, Sulphaguanidine, Sulphathiazole or by any other trade name."

Dated this ninth day of April, 1945.

ALAN NEWTON,
Chairman, Medical Equipment Control Committee, acting on behalf of the Chairman, Central Medical Co-ordination Committee.

Correspondence.

THESE INITIALS.

SIR: We read of U.N.R.R.A., A.N.G.A.U., S.H.A.E.F., E.L.A.S., U.N.C.I.O. and U.R.T.I. Perhaps some of us are familiar with A.W.L., S.N.L.R. and N.S.F. Even in the pages of THE MEDICAL JOURNAL OF AUSTRALIA we occasionally find small groups of capitals austerely quoted.

Recently I heard a new one. A patient told me that he had met a man who before the war was living hand to mouth, but who was now better dressed than a duke's valet and wore a diamond as big as a marble. My friend showed some surprise at this manifestation of wealth. However, the explanation was adequate. The man said: "Yes, I am doing well now; I have joined the B.M.A.—you know, the Black Market Association."

Perhaps, sir, the members of the British Medical Association should be warned that they have not the sole rights to these initials.

Yours, etc.,

W. L. CALOV.

157, Macquarie Street,
Sydney,
May 8, 1945.

Obituary.

JOHN SHEWAN.

WE are indebted to Professor W. K. Inglis for the following appreciation of the late Mr. John Shewan.

News of the recent death of John Shewan was received with deep regret by older graduates of the Sydney University Medical School.

John Shewan was born at Leith, Scotland, in 1856. After leaving school he joined the firm of T. and A. Constable, printers and publishers in Edinburgh. About 1876 he was appointed lecture assistant to Professor Rutherford, and he held this position for seven years. The work he did at Edinburgh Medical School included the drawing and colouring of the diagrams for illustrating the lectures, the obtaining and preparing of material for practical classes, and the making of many instruments used by the students in the practical classes. He made the first telephone exhibited in Edinburgh (from a description published in an American journal).

In 1883 John Shewan came to Sydney on the same ship as Dr. (afterwards Sir) Alexander MacCormick, both of them coming to Sydney to help Dr. (afterwards Sir) Thomas Anderson Stuart at the time of the establishment of the Medical School at the University of Sydney.

John Shewan's work in the early days in Sydney is well known to members of the profession. The excellence of his diagrams and of the instruments he prepared for the illustration of lectures in physiology, and for the use of students in practical classes, called for the highest praise.

After leaving the Medical School in 1910 he was appointed in 1911 acting curator of the Macleay Museum where he served until 1934. He made the artificial larynx which was of interest to students attending Professor Anderson Stuart's lectures in the early days. He also made the model of the original four-roomed medical school at Sydney. This model is in the historical section of the museum in the New Medical School, and a photograph of it appears in the latest medical students' "Year Book".

During recent years we have looked forward to Shewan's frequent visits to the university, and his courteous, considerate and kindly personality will be sorely missed.

ALBERT GEORGE CORBIN.

WE regret to announce the death of Dr. Albert George Corbin, which occurred on May 13, 1945, at Sydney.

Naval, Military and Air Force.

APPOINTMENTS.

THE undermentioned appointments, changes *et cetera* have been promulgated in the *Commonwealth of Australia Gazette*, Number 88, of May 3, 1945.

ROYAL AUSTRALIAN AIR FORCE.

Citizen Air Force: Medical Branch.

Flight Lieutenant D. A. S. Morgan (287465) is transferred from the Reserve to the Active Force with effect from 19th March, 1945.

Reserve: Medical Branch.

Temporary Wing Commander R. R. MacDonald (271192) is transferred from the Active List with effect from 9th March, 1945.—(Ex. Min. No. 114—Approved 26th April, 1945.)

Nominations and Elections.

THE undermentioned has applied for election as a member of the New South Wales Branch of the British Medical Association:

Cleland, Kenneth Wollaston (provisional registration), 1945 (Univ. Sydney), Goulburn District Hospital, Goulburn, New South Wales.

The undermentioned have been elected as members of the New South Wales Branch of the British Medical Association:

Allworth, Colin Travers, M.B., B.S., 1944 (Univ. Sydney), 147, Artarmon Road, Artarmon.

Burton-Bradley, Claudia Portia, M.B., B.S., 1943 (Univ. Sydney), 92, Ingham Avenue, Five Dock.

Chin, Ernest Favenc, M.B., 1940 (Univ. Sydney), 20, Hydebrae Street, Strathfield.

Conlon, Leonard Telford, M.B., B.S., 1938 (Univ. Sydney), 4, Rose Crescent, Mosman.

Elias, Leaton, M.B., 1938 (Univ. Sydney), Base Hospital, Wagga.

Hemphill, Betty Laun, M.B., B.S., 1941 (Univ. Sydney), 38, Elizabeth Street, Mayfield.

Hercus, Victor Macky, M.B., B.S., 1942 (Univ. Sydney), 82, St. George's Crescent, Drummoyne.

Lawson, Beryk Willard (provisional registration), 1945 (Univ. Sydney), 52, Stoney Creek Road, Bexley.

Lush, Studley Woolcott, M.B., B.S., 1937 (Univ. Sydney), 101, Victoria Road, Bellevue Hill.

Paige, Bruce Flood (provisional registration), 1945 (Univ. Sydney), 91, Warne Street, Wellington, New South Wales.

Snape, Margaret, M.B., B.S., 1944 (Univ. Sydney), St. George District Hospital, Kogarah.

Australian Medical Board Proceedings.

QUEENSLAND.

THE undermentioned has been registered, pursuant to the provisions of *The Medical Acts, 1939 to 1940*, of Queensland, as a duly qualified medical practitioner:

Cleghorn, Margaret Linnell, M.B., B.S., 1939 (Univ. Sydney), 159, Kent Road, Wooloowin.

Medical Appointments.

Dr. William Dinwoodie Ackland-Horman has been appointed anæsthetics registrar at the Royal Adelaide Hospital.

Dr. Donald Campbell Dawkins has been appointed orthopædic and gynæcological registrar at the Royal Adelaide Hospital.

Dr. Richard Alfred Amyas Pellew has been appointed honorary clinical assistant to the medical section at the Royal Adelaide Hospital.

Dr. Edmund Rupert Roseby has been appointed Government Medical Officer at Boggabri, New South Wales.

Books Received.

"Studies of Burns and Scalds", Reports of the Burns Unit, Royal Infirmary, Glasgow, 1942-43; Medical Research Council of the Privy Council, Special Report Series Number 249; General Introduction, by L. Colebrook; Part I, by L. Colebrook, T. Gibson and J. P. Todd; Part II, by L. Colebrook, A. M. Clark, T. Gibson and J. P. Todd; Part III, by T. Gibson and A. Brown; Part IV, by A. Brown; Part V, by A. B. Anderson; Part VI, by T. Gibson; with Appendices; 1944. London: His Majesty's Stationery Office. 9½" × 6", pp. 212, with many illustrations. Price: 4s. net.

"Mass Miniature Radiography of Civilians; For the Detection of Pulmonary Tuberculosis (Guide to Administration and Technique with a Mobile Apparatus using 35-mm. Film and Results of a Survey)"; Medical Research Council of the Privy Council, Special Report Series Number 251; by Kathleen C. Clark, P. D'Arcy Hart, Peter Kerley and Brian C. Thompson; 1945. London: His Majesty's Stationery Office. 9¾" × 6¼", pp. 140, with 57 illustrations. Price: 3s. net.

"A Handbook of Gynæcology for the Student and General Practitioner", by Bethel Solomons, B.A., M.D., F.R.C.P.I., F.R.C.O.G., M.R.I.A., F.A.C.S. (Hon.), and Edward Solomons, M.A., M.D., F.R.C.P.I., M.R.C.O.G., with a chapter on X Rays and Radium in Gynæcology by Oliver Chance, M.B., F.F.R., D.M.R.E.; Fourth Edition; 1944. London: Baillière, Tindall and Cox. 8" × 5¼", pp. 356, with many illustrations. Price: 25s.

"Catalogue of Lewis's Medical, Scientific and Technical Lending Library", New Edition; 1943. London: H. K. Lewis and Co. Limited. 8¼" × 5¼", pp. 931. Price: to subscribers, 12s 6d. net; to non-subscribers, 25s. net.

Diary for the Month.

MAY 14.—Victorian Branch, B.M.A.: Hospital Subcommittee.
MAY 14.—Victorian Branch, B.M.A.: Finance, House and Library Subcommittee.
MAY 15.—Victorian Branch, B.M.A.: Organization Subcommittee.
MAY 15.—New South Wales Branch, B.M.A.: Medical Politics Committee.
MAY 16.—Western Australian Branch, B.M.A.: General Meeting.
MAY 17.—Victorian Branch, B.M.A.: Executive Meeting.
MAY 17.—South Australian Branch, B.M.A.: Council Meeting.
MAY 22.—New South Wales Branch, B.M.A.: Ethics Committee.
MAY 23.—Victorian Branch, B.M.A.: Council Meeting.
MAY 24.—New South Wales Branch, B.M.A.: Clinical Meeting.
MAY 25.—Queensland Branch, B.M.A.: Council Meeting.
MAY 31.—New South Wales Branch, B.M.A.: Branch Meeting.
MAY 31.—South Australian Branch, B.M.A.: Scientific Meeting.
JUNE 1.—Queensland Branch, B.M.A.: Branch Meeting (Joseph Bancroft Memorial Lecture).
JUNE 5.—New South Wales Branch, B.M.A.: Organization and Science Committee.
JUNE 6.—Victorian Branch, B.M.A.: Branch Meeting.
JUNE 6.—Western Australian Branch, B.M.A.: Council Meeting.
JUNE 7.—South Australian Branch, B.M.A.: Council Meeting.

Medical Appointments: Important Notice.

MEDICAL PRACTITIONERS are requested not to apply for any appointment mentioned below without having first communicated with the Honorary Secretary of the Branch concerned, or with the Medical Secretary of the British Medical Association, Tavistock Square, London, W.C.1.

New South Wales Branch (Honorary Secretary, 135, Macquarie Street, Sydney): Australian Natives' Association; Ashfield and District United Friendly Societies' Dispensary; Balmain United Friendly Societies' Dispensary; Leichhardt and Petersham United Friendly Societies' Dispensary; Manchester Unity Medical and Dispensing Institute, Oxford Street, Sydney; North Sydney Friendly Societies' Dispensary Limited; People's Prudential Assurance Company Limited; Phœnix Mutual Provident Society.

Victorian Branch (Honorary Secretary, Medical Society Hall, East Melbourne): Associated Medical Services Limited; all Institutes or Medical Dispensaries; Australian Prudential Association, Proprietary, Limited; Federated Mutual Medical Benefit Society; Mutual National Provident Club; National Provident Association; Hospital or other appointments outside Victoria.

Queensland Branch (Honorary Secretary, B.M.A. House, 225, Wickham Terrace, Brisbane, B.17): Brisbane Associated Friendly Societies' Medical Institute; Bundaberg Medical Institute. Members accepting LODGE appointments and those desiring to accept appointments to any COUNTRY HOSPITAL or position outside Australia are advised, in their own interests, to submit a copy of their Agreement to the Council before signing.

South Australian Branch (Honorary Secretary, 178, North Terrace, Adelaide): All Lodge appointments in South Australia; all Contract Practice appointments in South Australia.

Western Australian Branch (Honorary Secretary, 205, Saint George's Terrace, Perth): Wiluna Hospital; all Contract Practice appointments in Western Australia. All Public Health Department appointments.

Editorial Notices.

MANUSCRIPTS forwarded to the office of this journal cannot under any circumstances be returned. Original articles forwarded for publication are understood to be offered to THE MEDICAL JOURNAL OF AUSTRALIA alone, unless the contrary be stated.

All communications should be addressed to the Editor, THE MEDICAL JOURNAL OF AUSTRALIA, The Printing House, Seamer Street, Glebe, New South Wales. (Telephones: MW 2651-2.)

Members and subscribers are requested to notify the Manager, THE MEDICAL JOURNAL OF AUSTRALIA, Seamer Street, Glebe, New South Wales, without delay, of any irregularity in the delivery of this journal. The management cannot accept any responsibility or recognize any claim arising out of non-receipt of journals unless such a notification is received within one month.

SUBSCRIPTION RATES—Medical students and others not receiving THE MEDICAL JOURNAL OF AUSTRALIA in virtue of membership of the Branches of the British Medical Association in the Commonwealth can become subscribers to the journal by applying to the Manager or through the usual agents and booksellers. Subscriptions can commence at the beginning of any quarter and are renewable on December 31. The rates are £2 for Australia and £2 5s. abroad *per annum* payable in advance.